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ARTICLES

DDT HAS A NAMESAKE IN DUTCH GUIANA (AN APPLICATION OF DDT TO COGNOMINATION)

BY H. H. STAGE

The Djoeka negro boy you see pictured here bears a name his family had never heard a year ago. He was born December 2, 1946, in Petro Ondro, a Djoeka village 120 miles by jungle from Paramaribo, Suriname (Dutch Guiana), and on that day was named DDT. I wrote the name down that way for his father, but the father didn't think three letters were enough for such an important name. So to please him I spelled it Daydaytay, which more nearly fits the Djoeka pronunciation of the name of the great insecticide.

Here is how it happened.

During the past year, by arrangement of an American mining company we have been testing DDT sprays in the vicinity of Moengo, Suriname. We have been trying to find how DDT will work as a means of killing mosquitoes and thus controlling malaria. To get rough estimates of how many mosquitoes were living in the vicinity before and after we applied the sprays, we used a light trap and a stable trap. The light trap is a cylinder of metal enclosing an electric lamp and a fan. Mosquitoes attracted by the lighted lamp enter it and then are forced by the fan into a bottle of cyanide. The stable trap encloses a living animal to which mosquitoes are attracted. After tanking up on the animal's blood they rest on the inside of the screen and cannot find their way out. The local boys making the tests also collected mosquitoes on their persons for 30 minutes at a time. (No, they did not get malaria because they watched the attackers and picked each one off before it bit.)

Between my first visit to Moengo, in March 1946, and my second, in January 1947, this work was handled by Bill Asgerali, a British-Indian boy. Each month Bill traveled up through the jungle from Moengo to Petro Ondro, carrying a light trap and a battery to operate it and leading a calf to bait the stable trap.

Just before dark on the evening of December 2, Bill arrived in the village of Petro Ondro to hear considerable noise. There was much excitement around one of the thatched-covered huts. He learned that a Djoeka woman had been in labor for two days in the hut. Evil spirits were preventing the baby from being born. The father, relatives, and friends had finally decided upon a dance as a means of frightening away these spirits. As Bill approached, they immediately hit upon the idea of enlisting the calf to assist them. The calf was the first one ever seen in the village. A strange animal, such as a calf, should prove very effective against the local evil ones, they thought. So Bill and the calf joined in the dance and procession around the hut. After a short time Bill had to leave to set up the traps. When he returned later to the ceremonies, he was told by the father that now all was well. The evil spirits had been chased away by the calf. A boy had been born. The father and relatives were greatly pleased and announced that the

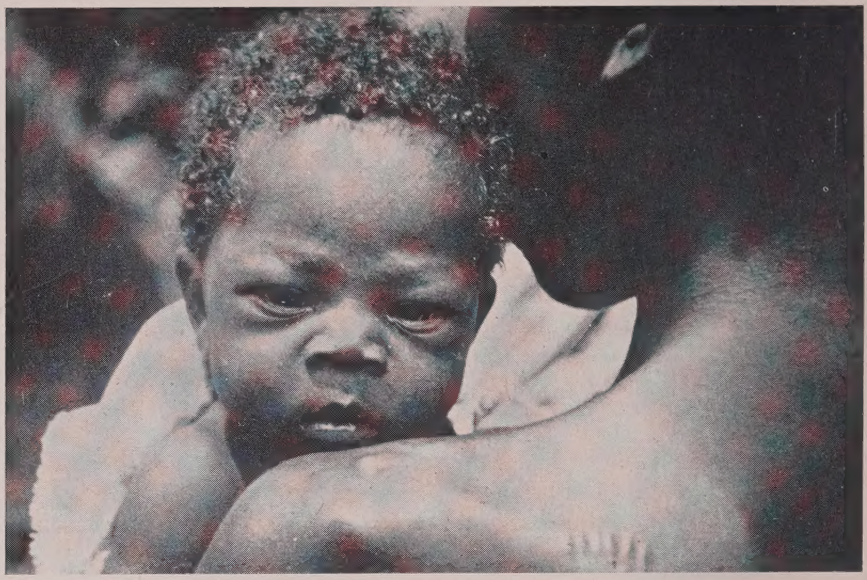

FIG. 1. Daydaytay

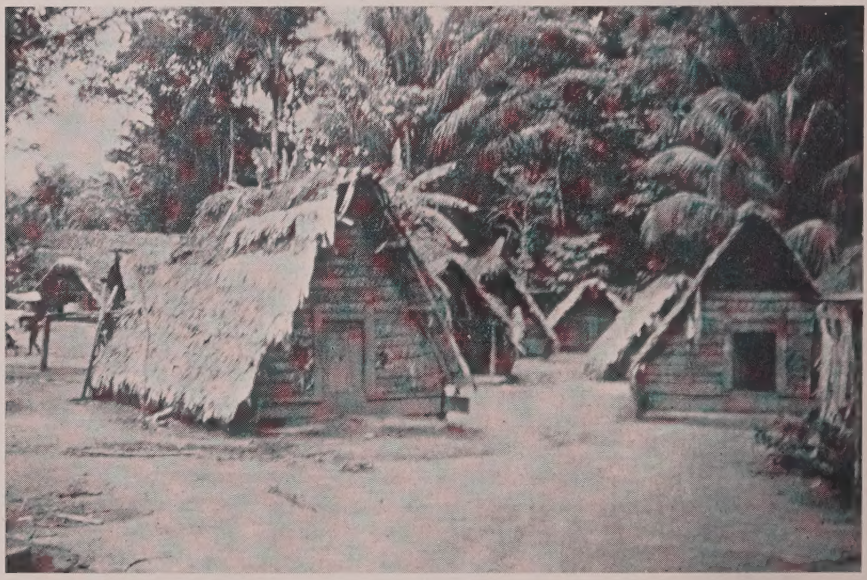

FIG. 2. Daydaytay's birthplace in Petro Ondro, Suriname, South America.

baby would be called Asgerali in honor of the aid Bill had given.

Now Bill is not so dumb. After some quick thinking, he decided it might not be advantageous in after years for a Djoeka boy named Asgerali to be seen around Moengo. After all, he had been spending two nights each month for many months in this village. He quickly said, "No, don't name baby Asgerali. Name boy after work I do. Name boy DDT." What could be more appropriate?

When I visited Petro Ondro two months later I learned the story from Bill and Bachraman, DDT's father. So far as I was able to determine, DDT is the only individual in the village whose birthdate is known. I took these pictures of DDT and his parents and the hut where he was born, and was duly appointed DDT's godfather.

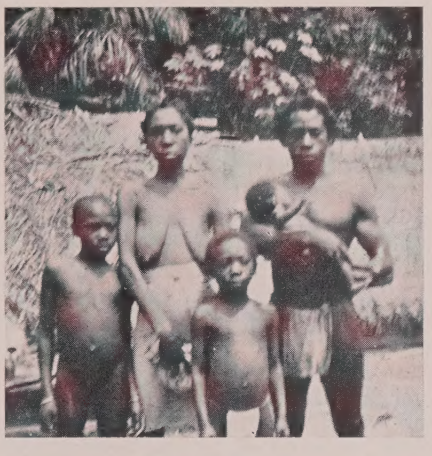

FIG. 3. Daydaytay's family. From left to right: his sister, Sajhi; his mother, Belieka; his brother, Bangaulie; and his father, Bachraman.

CALIFORNIA GROUND THERMAL AEROSOL GENERATOR

THEODORE G. RALEY
Manager [1, 2] Sutter-Yuba Mosquito Abatement District
Photographs and Drawing by ROBERT F. PORTMAN

Mosquito control in California by mosquito abatement district has experienced a rapid expansion during and subsequent to World War II. Several thousand additional square miles of area, much of it sparsely populated, have become part of new districts or have been annexed to existing districts. In some cases, the limited local tax revenue has restricted the size of the organization needed successfully to accomplish the control requirements of the districts. This has caused Managers of several districts some considerable consternation. The use of conventional spray methods under these expanded conditions, even with the employment of DDT, was found to be inadequate for keeping under control continuously irrigated lands characteristic of certain regions in the Central Valley of California.

Such was the challenge which confronted certain California mosquito abatement districts, and the following deals with how this challenge was met and neutralized. Scene of this paper is the irrigated region in Sutter and Yuba Counties in California, which began mosquito control as an organized district in the spring of 1946, directing efforts against the hordes of mosquitoes which have occurred there year after year. Many of the residents of these counties passed judgment upon the undertaking as a misuse of public funds, because of the vast irrigated acreage and standing water, and they questioned the wisdom of even trying to accomplish this seemingly futile task. For a while during the early period of the district's operations, when the emergence of *Aedes dorsalis, Aedes nigromaculis, Aedes vexans* and *Aedes lateralis* became widespread, the district personnel were also made to wonder if they possessed the wherewithal to get the upper hand on the mosquito population. It was this urgent situation which provided for necessity to mother invention and thus give rise to what has since been referred to in California as the "plumber's nightmare".

In early 1946 two commercial agencies, (the TIFA and Bes-Kil), had already demonstrated their ground aerosol units in California, but as has been previously mentioned, the budget limitations of the Sutter-Yuba Mosquito Abatement District, as well as other districts, didn't permit purchase of more than one such unit in view of their list price. One unit would have been helpful, but the outstanding need was that of complete treatment of approximately 350 square miles of prolific breeding area simultaneously.

Hence it was, that with the venturi principle for obtaining thermal aerosol in mind, improvising began on a ground exhaust aerosol generator, using galvanized pipe and pipe fittings to fashion the device. Since the district was using a fleet of seven War Assets Administration surplus Dodge 4x4, one-half ton trucks in its operations, one of these was dedicated to the cause of experimental research. By trial and error, the generator described in this paper was developed and used extensively on all of the district vehicles, with very gratifying results. Easily installed and inexpensive to operate, it made a very welcome addition to our equipment. Working with the generators, not as a

[1] Theodore G. Raley is now Manager of the Consolidated Mosquito Abatement District, Fresno County, California.

[2] Material from this paper was presented by Mr. Harold F. Gray at the annual meeting of the American Mosquito Control Association in Philadelphia, Pa., April 5, 1947, as a contribution from the California Mosquito Control Association.

cure-all, but as an aid in killing adult mosquitoes and mosquito larvae, the control crews made a good many people happy. Installed as part of the vehicle, crews could work with it any time of the day or night as occasion demanded.

After experimenting with several types of thermal aerosal generators, the "plumber's nightmare" was installed on all trucks operated by the district. The average cost for the complete unit, including tank, was thirty-five dollars. Any of the men could operate the unit with very little danger of burning vegetation, injury to the operator or damage to domestic or wild life. Pastured stock seemed to enjoy being "fogged" and would drift toward the area being treated. At first a little trouble was experienced in making U turns down wind but by executing a full circle turn across the next "swath" to be fogged, the operator avoided turning into his own smoke. Very little difficulty was encountered by operating the generator from the windward side of the truck. The forward speed of the vehicle, 5 to 8 miles an hour, allowed the aerosol to flow behind the vehicle with very little loss in efficiency. An effort was made to operate the generator from the lee side of the truck whenever heavy vegetation was encountered, particularly along ditches and sloughs.

The most spectacular result from the generator was, of course, the almost immediate adult kill obtained. Better public relations were developed by fogging than by all other control measures combined. Field laborers, fruit workers, warehousemen, urban residents and hunters were loud in their praise of the "mosquito smoking." Irrigators in the large pastures swore that the district did more good in half an hour with the fog machine than had been done in weeks by conventional spraying. Orchards, large truck crop areas and duck clubs were freed from all existing adult mosquitoes shortly after fogging. Two cities in the district were treated in the early evening and everyone seemed to feel the district was doing something worthwhile. Buildings could be treated very quickly with complete penetration to all cracks and covered places. A pipe extension was used to allow the operator to treat under houses, basements, and buildings not located conveniently with respect to the truck. The small amount of material discharged, approximately 10 gallons an hour, caused no damage to any of the building area. By using the extension pipe the possibility of depositing too much oil near the mouth of the venturi was reduced. Many other pest insects other than mosquitoes were killed as well. No evidence was encountered of injury to honey bees or other beneficial insects.

For practical mosquito control the exhaust venturi offers a tool that in many ways is superior to pressure spray equipment. Any mosquito source that can be reached with a truck can be covered more thoroughly by the aerosol than by hand operated spray nozzles. Crews are more apt to miss spots with the spray guns than they are with the aerosol. A nearly complete larval kill, up to fifty feet, was obtained by the exhaust aerosol at any time of the day. "Swaths" of fifty feet were found to be effective in controlling larvae in irrigated pasture lands. Temperature and wind velocity, up to fifteen miles an hour, did not materially affect the range of kill. A brisk wind actually increased the distance covered, even though the visual smoke dissipated rapidly. Vegetation did not seem to decrease the efficiency of the generator. Under favorable conditions such as early evening when a light wind was blowing, good larval kill was obtained up to 400 feet. In areas where the four wheel drive trucks can "swath," one operator can cover several hundred acres in one day. This method of control kills not only larvae but existing adults as well, thereby reducing the potential egg and larvae crop. No damage to field or pasture crops was observed.

Possible harm to the truck motors did not materialize. No excessive heating was observed and a loss in power did not slow the truck enough to be noticeable.

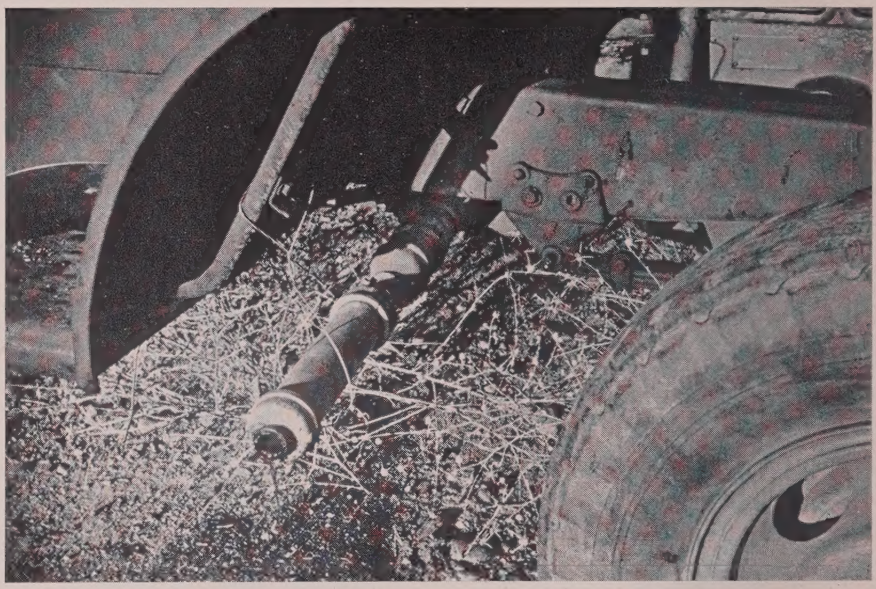

FIG. 1. The "Plumber's Nightmare" in closeup. The DDT solution is introduced by gravity feed from a tank in the rear of the truck through a copper fuel line into the throat of the venturi. Note solution dripping over the edge of the reservoir cap when exhaust pressure from motor stops.

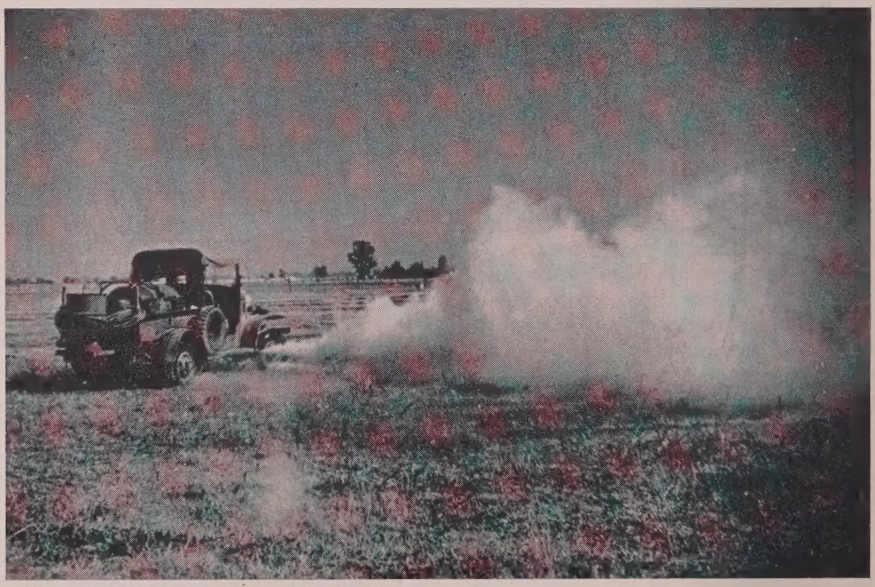

FIG. 2. The "fog" begins to appear as the vehicle sets out to control this over-irrigated pasture. Such aerosol type control can be accomplished in one-fifth the time required for power spraying, thus resulting in a corresponding economy of operations while obtaining both larval and adult mosquito control.

FIG. 3. Full volume aerosol output is here being accomplished, which means death to larvae within fifty to one hundred feet and complete control of adult mosquitoes from within one hundred yards up to one-half mile. A valve controlling the DDT solution is within reach of the driver, which makes for uninterrupted travel and use of the aerosol only when needed.

FIG. 4. This Jeep is successfully negotiating a flooded pasture. As long as the "Plumber's Nightmare" remains above water, its mosquiticidal action continues. The aerosol under conditions of low relative humidity and moderate wind is inclined to rise somewhat, but in the presence of ponds it drops to hug the water surface.

Practically all the work in the field was done with the truck operating in compound low gear. This low gear driving will perhaps shorten the life of a motor, but the saving in manpower and the increased efficiency of control will more than offset the cost of even a new motor each year. The valves on the two trucks that had been "fogging" for the longest period of time were inspected and no damage was observed.

The descriptive diagram shows the wide latitude possible in the position of the venturi throat by a simple shifting of pipe nipples. This position of the throat, when the material is introduced, to the truck manifold is very important. The particle size of the aerosol can be regulated by the distance of the first reducer from the engine manifold. If the aerosol is too fine (dry fog) very poor results on larvae kill will be obtained. A dry fog will not drift for as long a distance when field adulticiding is attempted. The long nipple with the reducer cap acts as a reservoir, holding excess material until the exhaust heat and velocity is able to break it up. Some dripping will occur if the generator is too cold or if the motor speed is too slow. A control valve on the feed line will regulate the flow of material. The reservoir helps to prevent foliage burning at the mouth of the generator, especially when the truck slows to turn or cross a ridge. A jet type feed line, centered in the throat of the venturi will fill with carbon very quickly and must be removed and cleaned often. The material is carried to the generator by gravity.

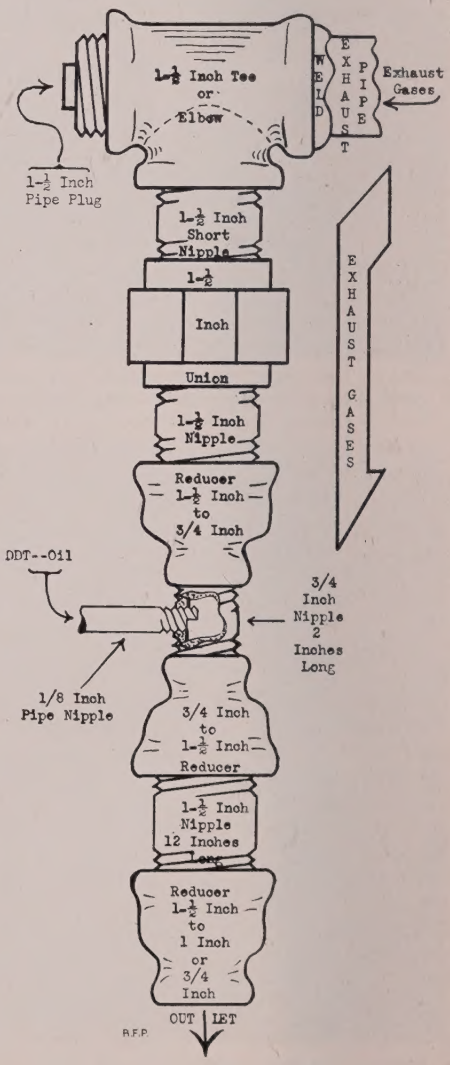

FIG. 5. CALIFORNIA GROUND THERMAL AEROSOL GENERATOR. Originated by Sutter-Yuba Mosquito Abatement District, Theodore G. Raley, Manager.

This vehicle exhaust venturi is welded to a short piece of exhaust pipe and coupled by the usual fitting to the exhaust manifold. It extends horizontally under the vehicle frame, and under the fender, back of the front wheel.

For "fogging" buildings, a number of lengths of two inch sheet iron drain or flue pipe may be used as an extension, by slipping it over the end of the venturi.

When not used for "fogging," the venturi acts as an exhaust muffler.

The specifications given in this diagram are for use in constructing a venturi to be used with a vehicle engine of approximately 90 horsepower.

The material used in this aerosol generator is equivalent to that used for airplane thermal aerosol work. Any DDT solvent capable of dissolving over 5% DDT and possessing a viscosity somewhat heavier than diesel oil is suitable. The addition of a spreading agent such as B 1956, in the amount of approximately 12 to 16 ounces per 100 gallons of material, is particularly desirable for larvicidal work. The formula commonly used in California consists of one-third 25% DDT xylene concentrate, one-third diesel oil and one-third strained crankcase flushings. This produces a DDT concentration of approximately 8 and ⅓%. A DDT percentage somewhat higher than this will most likely prove even more effective for larval kill.

During the latter part of 1946, the civilian ¼ ton Jeep became a basic unit in California mosquito control, particularly in the expanded area of the Central Valley. Nearly all of the Jeeps are equipped with a light power sprayer and an aerosol generator patterned after the device described for the larger vehicle and shown in the accompanying diagram. The Jeep aerosol generator varies from the accompanying diagram in that 1¼ inch pipe and fittings are used along with ½ inch venturi throat and cap reducer. The generator is installed on the Jeep by cutting the exhaust pipe close to the manifold and welding on an elbow. Experience with this Jeep aerosol generator has shown that when a venturi throat of ½ inch is used, carbonization of the orifice of the feed line will occur. This may be eliminated by draining the feed line through the installation of an air intake into the feed line. Frequent comments have been made concerning the possible back pressure exerted upon the motor by the aerosol generator and other possible injurious effects likely to result from this installation. In order to answer these questions, exhaustive tests were performed by a Willys Corporation Factory Representative on a Jeep equipped with a "plumber's nightmare", which revealed no deleterious effects upon the motor. Their tachometer indicated a reading of 2600 RPM at normal operating range producing ample discharge pressure. 3500 RPM would be considered racing. The manifold pressure gauge indicated only a 20 lb. per square inch pressure, which is normal. The increased pressure developed when a vehicle starts was also found to be normal. A slight increase in motor temperature was noted, which the Factory Representative indicated was not objectionable, but rather was desirable for better motor efficiency.

Thus far, results on the performance of the "plumber's nightmare" have not been completely measured. One of the objects of the California State Department of Public Health, Mosquito Control Section, in co-operation with local mosquito abatement districts, during 1947 will be to attempt to determine the effective control range of this aerosol generator for both larval and adult mosquitoes under specified meteorological conditions. Observations, thus far, indicate that atmospheric conditions are of great significance in affecting the range of efficient use of this aerosol generator. We, in California, are confident however, that this aerosol principle, properly used, will result in considerable saving of time, trouble, and expense under most atmospheric conditions. Refinement of this technique of ground thermal aerosol application should enable it to play a large part in the larval and adult control work, both in California and elsewhere. Well over half of the 37 mosquito abatement districts in California have already installed these units and it can be safely predicted that they will utilize them as an important part of their operations in the 1947 mosquito season.

THE BIOLOGY AND DISTRIBUTION OF *MEGARHINUS* ROBINEAU-DESVOIDY IN FLORIDA [1]

ERNESTINE H. BASHAM,[2] J. A. MULRENNAN,[3] AND A. J. OBERMULLER [4]
Florida State Board of Health, Bureau of Malaria Control, Jacksonville

The tribe *Megarhinini* consists of one genus of large, usually brilliant-colored diurnal mosquitoes (1). As the proboscis is curved downward, and not fitted for puncturing (4), the adults feed on nectar and plant juices (5). The larvae have been collected from tree holes, bamboo stems, leaf bases of *Bromeliaceae* (5), rock holes (2), rain barrels and other wooden receptacles, and even from metallic receptacles (3). Usually very large, the larvae are predacious (5). The genus is primarily a tropical one, but its distribution extends into the North Temperate Zone (1). Two species are recognized in the United States.

Megarhinus septentrionalis Dyar and Knab occurs in the eastern United States, north to New Jersey, west to Kansas and Texas (1). In the collection of the Florida State Board of Health there are three specimens from Florida which appear to be *M. septentrionalis* D. & K., according to keys published by Carpenter (1) and King, Bradley, and McNeel (4). Two males were collected from Cecil Field, Jacksonville, Florida, by W. E. Goldman on July 27 and September 12, 1943, respectively, and one male was collected from Tallahassee, Florida, by W. E. Goldman on April 9, 1946.

Megarhinus rutilus Coquillett occurs in Florida, Georgia, and South Carolina (1). The two species are indistinguishable in the larvae, male terminalia (2), and females (5). The males are distinguished only by the fore tarsal markings (4).

M. rutilus Coq. larvae and pupae were collected and reared by the authors from holes in water oak, live oak, scrub oak, orange, pecan, and pine trees, and from the following number and types of artificial containers: Three glass jars, two 1-gallon tin cans, three wooden rain barrels, an automobile tire, two 50-gallon steel barrels, an enamel cooking pan, a rowboat, a wash tub, and a metal syrup kettle. All artificial containers were located under or near trees, partially filled with debris and decomposing vegetation, and exposed to short periods of sunlight. Larvae taken in association with this species were: *Orthopodomyia signifera* (Coquillett), *Aedes triseriatus* (Say), *Culex quinquefasciatus* Say, and *Culex nigripalpus* Theobald.

Observations on feeding habits and length of larval stadia of three specimens are presented in Table I. It was noted that specimen No. 1 as a first instar was capable of remaining submerged for 34 minutes and specimen No. 3 as a fourth instar, for 16 minutes and 21 seconds.

A total number of 51 *M. rutilus* Coq. larvae were collected by the authors in four counties of Florida, from July to October 1946, as indicated in Table II. Other county records of *M. rutilus* Coq. on file with the Florida State Board of Health are: Broward County, Ft. Lauderdale, one reared male August 10, 1945, and one reared female September 12, 1945 (E. L. Seabrook-T. E. Duffey); Duval County, Jacksonville, two larvae June 12, 1943 (Bialolenki-Goldman), two females March 2, 1945, one female March 12, 1945, one male June 11, 1945, one male July 27, 1945, one male September 25, 1945 (Henry Hanson), one reared

[1] From Bureau of Malaria Control, Florida State Board of Health, Jacksonville, Florida, CDC Activities, U. S. Public Health Service.

[2] Biological Aide, CDC Activities, U. S. Public Health Service.

[3] Entomologist and Director of Bureau of Malaria Control, Florida State Board of Health, Jacksonville, Florida.

[4] Engineering Aide, CDC Activities, U. S. Public Health Service.

TABLE I. Feeding Habits and Length of Larval Stadia of Three *M. rutilus* Coq. Larvae Collected in Florida

Spec. No.	County	Town	Habitat	Date Collected	Instar	Feeding Habits	Pupated	Emerged	
1	Sumter	Bushnell	Live Oak tree hole	7/6/46	1st	Devoured 87 *O. signifera* (Coq.) (all instars) 31 *A. triseriatus* (Say) (all instars)	7/22/46	7/26/46	Male
2	Levy	Chiefland	Scrub Oak tree hole	7/26/46	3rd	Devoured 57 *O. signifera* (Coq.) (3rd and 4th instars) 50 *A. triseriatus* (Say) (4th instars) 5 *C. quinquefasciatus* Say (4th instars)	8/17/46	8/22/46	Male
3	Citrus	Inverness	Live Oak tree hole	7/22/46	4th	Devoured 10 *O. signifera* (Coq.) (3rd and 4th instars) 51 *A. triseriatus* (Say) (3rd and 4th instars) 10 *C. quinquefasciatus* Say (3rd and 4th instars)			Male

TABLE II. Collection Data on *M. rutilus* Coq. in Four Florida Counties

County	Town	Date Collected	No. Larvae Collected	Adults Reared
Citrus	Inverness	7/22/46	2	Male—Female
Citrus	Inverness	7/26/46	2	
Citrus	Inverness	9/18/46	7	
Hernando	Nobleton	8/1/46	1	Male
Hernando	Brooksville	9/4/46	2	2 Males
Hernando	Spring Lake	9/—/46	2	Male—Female
Hernando	Bay Port	9/11/46	1	
Hernando	Mud River	10/2/46	4	Male
Hernando	Brooksville	10/30/46	2	
Levy	Chiefland	7/26/46	6	3 Males—3 Females
Levy	Chiefland	7/28/46	1	
Levy	Williston	8/19/46	3	Male—Female
Levy	Cedar Keys	8/23/46	8	Female
Levy	Raleigh	10/31/46	4	
Levy	Williston	10/31/46	4	
Sumter	Bushnell	7/6/46	1	Male
Sumter	St. Catherine	9/17/46	1	Male

female August 22, 1945, one reared male and one reared female August 27, 1945 (A. E. Pritchard-E. H. Basham); Leon County, Tallahassee, 1943 (J. A. Mulrennan); Palm Beach County, Boca Raton, one reared male October 21, 1945, and one reared female November 9, 1945 (E. L. Seabrook-T. E. Duffey); and Volusia County, Deland, 1943 (J. A. Mulrennan).

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COMPARATIVE TOXICITY OF DDT TO THREE REPRESENTATIVE SPECIES OF MOSQUITO LARVAE [1]

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In laboratory tests with DDT different species of mosquitoes have shown a variation in their tolerance to this chemical. Different lots of larvae of the same species have also shown a variation in their resistance to DDT poisoning. Field tests (Eide, 1945) have shown that this variation in the susceptibility of different species to DDT is very important. The purpose of this paper is to compare the effectiveness of several DDT treatments against *Anopheles quadrimaculatus* Say, *Aedes aegypti* (L.), and *Culex quinquefasciatus* Say. One experiment was conducted with two suspensions and an emulsion that dispersed the DDT uniformly throughout the water, in which the applications were made on a parts-per-million basis, and another experiment with surface applications of solutions and emulsions containing petroleum oil.

Experimental Procedure. In the first experiment the procedure described by Bushland and King (1943) was followed. Distilled water (250 ml.) was added to each 400-ml. beaker; approximately 25 ml. was poured from this beaker into a 50-ml. beaker; 20 early fourth-instar larvae were also placed in the small beaker. After the proper aliquot of the emulsion or the suspension had been placed in the 400-ml. beaker and thoroughly mixed, the water containing the larvae was added. This method protected the larvae from being immersed suddenly into a high concentration of the toxic material.

One suspension consisted of DDT (twice recrystallized) in acetone solution. Another stable water suspension was made from a concentrate containing 10 percent of DDT, 10 per cent of Nopco 1216 (sulfonated sperm oil), and 80 per cent of Cellosolve (ethylene glycol mono ethyl ether). A stable water emulsion was made from a concentrate composed of 25 per cent of DDT, 10 per cent of Triton X-100 (an aralkyl polyether alcohol), and 65 per cent of xylene. Each of these formulations was diluted to 1 part of DDT in 500,000 parts of water, and the aliquots were applied with pipettes of graduated sizes for the desired parts per million in 250 ml. of water.

The surface applications were made in an 8 by 8-foot spray chamber. The solutions and emulsions were applied to three lots of 20 fourth-instar larvae in paper ice-cream cartons containing distilled water. The three lots of larvae were placed beneath the spray opening in the chamber and were spaced along the arc of a circle having a diameter of 26 inches so that they would not be directly under the sprayer nozzle.

The solutions and emulsions were atomized through a hole in the ceiling of the chamber by means of a sprayer connected to an air compressor delivering 10 pounds pressure.

The dosage was computed on the basis of total area covered by the spray. The amount of material to be sprayed into the chamber was therefore governed by the DDT content and the desired dosage.

Mortality readings were taken at 24- and 48-hour intervals. All the larvae

[1] This work was conducted under a transfer of funds, recommended by the Committee on Medical Research, from the Office of Scientific Research and Development to the Bureau of Entomology and Plant Quarantine.

[2] Sergeant, U. S. Army, assigned from Army Air Forces Committee on Aerial Dispersal of Insecticides, located at Army Air Forces Center, Orlando, Fla.

were forced to submerge. Larvae of *Anopheles quadrimaculatus* were considered dead if they were unable to come to the surface, and those of *Aedes aegypti* and *Culex quinquefasciatus,* which have different feeding habits, if they failed to react to a fine teasing needle. Feeding habits of the different species do not affect their exposure to DDT when it is in colloidal suspension; therefore, any variation between species is due to differences in susceptibility.

The petroleum oil solutions and emulsions were applied to the surfaces and were not uniformly distributed throughout the media. Those that contained Velsicol NR-70 (chiefly tetramethylnaphthalene) remained on the surface even though the specific gravity was greater than that of water.

Results.—The results in Table 1 show the effect on larvae taken at random from the same population, of various dosages of preparations in which the DDT was uniformly dispersed throughout the media. Table 2 shows results of similar tests when the DDT was applied to surfaces.

Culex quinquefasciatus larvae were much more resistant to the toxic action of DDT, in both parts-per-million and surface applications (Table 2), than were larvae of

TABLE 1. Toxicity to Mosquito Larvae of DDT Suspensions and an Emulsion in which the DDT Was Uniformly Dispersed Throughout the Water. Average of 3 replications.

Treatment	Dosage of DDT	Mean Mortality					
		Culex quinquefasciatus		*Anopheles quadrimaculatus*		*Aedes aegypti*	
		24 hours	48 hours	24 hours	48 hours	24 hours	48 hours
	P.p.m.	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
DDT 10%, Nopco 1216 10%, Cellosolve 80% (stable water suspension)	0.025	85.0	96.6	....	....	....	....
	.0125	31.6	33.3	....	....	....	....
	.01	1.6	1.6	....	....	....	....
	.005	....	....	86.6	96.2	....	....
	.0025	....	....	33.3	59.2	86.6	91.6
	.00166	....	....	11.6	46.2	80.0	86.6
	.00125	....	....	....	....	78.3	86.6
DDT 25%, Triton X-100 10%, xylene 65% (stable water emulsion)	.025	88.3	98.3	....	....	....	....
	.0125	13.3	31.6	....	....	....	....
	.01	0	5.0	....	....	....	....
	.005	....	....	86.6	96.2	....	....
	.0025	....	....	11.6	57.3	91.6	98.3
	.00166	....	....	5.0	27.8	95.6	98.3
	.00125	....	....	....	....	83.3	86.6
DDT acetone-water suspension	.025	76.6	90.0	....	....	....	....
	.0125	10.0	11.6	....	....	....	....
	.01	6.6	15.0	....	....	....	....
	.005	....	....	93.3	98.1	....	....
	.0025	....	....	45.0	75.9	91.6	95.0
	.00166	....	....	1.6	40.7	71.6	86.6
	.00125	....	....	....	....	58.3	73.3

TABLE 2. Toxicity to Mosquito Larvae of DDT Solutions and Emulsions in which the DDT Was Not Uniformly Dispersed Throughout the Water. Average of 3 replications.

Treatment	Dosage of DDT [3]	Mean Mortality					
		Culex quinquefasciatus		*Anopheles quadrimaculatus*		*Aedes aegypti*	
		24 hours	48 hours	24 hours	48 hours	24 hours	48 hours
	Pound per acre	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
DDT (%) in No. 2 fuel oil:							
5	0.05	98.6	98.6	....	....	....	....
	.025	78.3	80.0	....	....	83.3	92.7
1	.02	....	....	....	....	95.0	98.6
	.015	3.3	6.6	....	....	90.0	96.6
	.01	....	....	....	....	60.0	93.3
	.005	....	....	....	....	43.3	70.0
0.5 [1]	.0025	....	....	60.0	66.8	....	....
	.0025	....	....	66.3	83.1	....	....
DDT (%) in Velsicol NR–70:							
5	.05	95.0	95.0	....	....	....	....
	.025	80.0	81.6	....	....	....	....
0.5	.01	11.6	23.3	....	....	5.0	8.3
	.005	11.6	20.0	....	....	0	8.3
	.0025	0	8.3	52.9	70.5	1.6	5.0
DDT emulsion:							
5% [2]	.05	100.0	....	....	....	....	....
	.025	93.3	93.3	....	....	....	....
1% [2]	.015	13.3	18.3	....	....	....	....
5% [3]	.05	100	....	....	....	....	....
	.025	96.6	96.6	....	....	....	....
1% [3]	.015	58.3	61.6	....	....	....	....
Xylene (0.5%) emulsion	0.0025	....	....	35.0	43.15	....	....
No. 2 fuel oil	....	5.0	11.6	....	....	5.0	6.6
Velsicol NR–70	....	18.3	30.0	....	....	3.3	8.3

[1] 80% No. 2 fuel oil, 20% S.A.E. No. 30 lube oil.
[2] Made from 25% DDT concentrate in PD–544–C (an aromatic petroleum fraction).
[3] Made from 20% DDT concentrate in Velsicol NR–70.

Anopheles quandrimaculatus and *Aedes aegypti*. This is evident from the much higher concentration required for a minimum lethal dosage, and the greater amount of material necessary to obtain the desired results with surface applications. *Anopheles* and *Aedes* larvae were both affected by the lower dosages, *Aedes* being more susceptible when the DDT was diffused throughout the media and much less susceptible when it was applied to the surface.

The difference in susceptibility between *Anopheles quadrimaculatus* and *Aedes aegypti* may have been due to a difference in their feeding habits. Since the *Anopheles* larvae are primarily surface feeders, they are easily affected by either type of application, whereas the *Aedes* larvae, which are habitually bottom feeders, are less susceptible to surface applications.

The greater resistance of *Culex* larvae to the DDT applications at all dosages cannot be explained on the basis of feeding habits, and can be accounted for only by assuming that this species possesses an inherent resistance to the toxic material.

When dusts containing DDT were ap-

plied to the surface of water containing these three species of mosquito larvae, they were effective against *Anopheles* but ineffective against *Aedes* and *Culex*. Again this may be explained on the basis of feeding habits, since only the larvae of *Anopheles* would actually feed on the surface and be affected by small dosages. As shown in Table 1, however, materials dispersed throughout the water control all three species.

Summary.—Great variation in susceptibility to the toxic action of various DDT emulsions, suspensions, and solutions, applied so that the DDT was diffused throughout the media or to the surface only, was shown among larvae of *Culex quinquefasciatus* Say, *Anopheles quadrimaculatus* Say, and *Aedes aegypti* (L.). The *Culex* larvae were highly resistant to DDT regardless of how it was applied, and required a much higher concentration for a minimum lethal dosage than did the *Anopheles* or the *Aedes* larvae. Against *Aedes aegypti* the treatments in which the DDT was diffused throughout the media gave high mortality at much lower dosages than did the surface applications. This variation between treatments might be due to a difference in the feeding habits of the mosquitoes, since *Anopheles quadrimaculatus,* which is primarily a surface feeder, required a lower dosage of DDT in the surface applications than did *Aedes aegypti,* which is habitually a bottom feeder. The greater resistance of *Culex* larvae to the DDT at all dosages cannot be explained on the basis of feeding habits, and can be accounted for only by assuming that this species possesses an inherent resistance to the toxic material.

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COMMON NAMES OF INSECTS OF MEDICAL IMPORTANCE APPROVED BY THE AMERICAN ASSOCIATION OF ECONOMIC ENTOMOLOGISTS

C. F. W. MUESEBECK

I. INSECTS LISTED BY COMMON NAMES

American dog tick—*Dermacentor variabilis* (Say)
bed bug—*Cimex lectularius* L.
black blow fly—*Phormia regina* (Meig.)
black horse fly—*Tabanus atratus* F.
black widow spider—*Latrodectus mactans* (F.)
bloodsucking conenose — *Triatoma sanguisuga* (Lec.)
body louse—*Pediculus humanus corporis* Deg.
brown dog tick—*Rhipicephalus sanguineus* (Latr.)
brown-tail moth — *Nygmia phaeorhoea* (Donov.)
cat flea—*Ctenocephalides felis* (Bouché)
chigger — *Eutrombicula alfreddugèsi* (Oud.)
chigoe—*Tunga penetrans* (L.)

common malaria mosquito — *Anopheles quadrimaculatus* Say
crab-hole mosquito — *Deinocerites cancer* Theob.
crab louse—*Phthirus pubis* (L.)
crinkled flannel moth—*Megalopyge crispata* (Pack.)
dog flea—*Ctenocephalides canis* (Curt.)
false stable fly—*Muscina stabulans* (Fall.)
fire ant—*Solenopsis geminata* (F.)
floodwater mosquito — *Aedes sticticus* (Meig.)
giant hornet — *Vespa crabro germana* Christ
hag moth — *Phobetron pithecium* (A. & S.)
head louse—*Pediculus humanus humanus* L.
house centipede — *Scutigera cleoptrata* (L.)
house fly—*Musca domestica* L.
human flea—*Pulex irritans* L.
human bot fly—*Dermatobia hominis* (L., Jr.)
io moth—*Automeris io* (F.)
itch mite—*Sarcoptes scabiei* (Deg.)
latrine fly—*Fannia scalaris* (F.)
little fire ant—*Wasmannia auropunctata* (Roger)
little house fly—*Fannia canicularis* (L.)
lone star tick—*Amblyomma americanum* (L.)
northern house mosquito—*Culex pipiens* L.
northwest coast mosquito—*Aedes aboriginis* Dyar
northwestern floodwater mosquito—*Aedes lateralis* (Meig.)
oriental house fly—*Musca vicina* Macq.
oriental rat flea — *Xenopsylla cheopis* (Rothsch.)
Pacific Coast tick—*Dermacentor occidentalis* Neum.
relapsing-fever tick — *Ornithodoros turicata* (Dugès)
Rocky Mountain wood tick—*Dermacentor andersoni* Stiles
saddleback caterpillar — *Sibine stimulea* (Clem.)
southern buffalo gnat—*Eusimulium pecuarum* (Riley)
southern fire ant — *Solenopsis xyloni* McCook
southern house mosquito—*Culex quinquefasciatus* Say
Spanish-fly—*Lytta vesicatoria* (L.)
stable fly—*Stomoxys calcitrans* (L.)
sticktight flea — *Echidnophaga gallinacea* (Westw.)
straw itch mite—*Pediculoides ventricosus* Newp.
striped horse fly—*Tabanus lineola* F.
tropical rat mite — *Liponyssus bacoti* (Hirst)
turkey gnat — *Simulium meridionale* Riley
western chicken flea—*Ceratophyllus niger* Fox
western tree-hole mosquito—*Aedes varipalpus* (Coq.)
wheel bug—*Arilus cristatus* (L.)
yellow-fever mosquito — *Aedes aegypti* (L.)

II. Insects Listed by Scientific Names

Aedes aboriginis Dyar—northwest coast mosquito
Aedes aegypti (L.)—yellow-fever mosquito
Aedes lateralis (Meig.) — northwestern floodwater mosquito
Aedes sticticus (Meig.)—floodwater mosquito
Aedes varipalpus (Coq.)—western tree-hole mosquito
Amblyomma americanum (L.)—lone star tick
Anopheles quadrimaculatus Say—common malaria mosquito
Arilus cristatus (L.)—wheel bug
Automeris io (F.)—io moth
Ceratophyllus niger Fox—western chicken flea
Cimex lactularius L.—bed bug
Ctenocephalides canis (Curt.)—dog flea
Ctenocephalides felis (Bouché)—cat flea
Culex pipiens L.—northern house mosquito
Culex quinquefasciatus Say — southern house mosquito
Deinocerites cancer Theob. — crab-hole mosquito

Dermacentor andersoni Stiles — Rocky Mountain wood tick
Dermacentor occidentalis Neum.—Pacific Coast tick
Dermacentor variabilis (Say)—American dog tick
Dermatobia hominis (L., Jr.)—human bot fly
Echidnophaga gallinacea (Westw.)—stick-tight flea
Eusimulium pecuarum (Riley)—southern buffalo gnat
Eutrombicula alfreddugèsi (Oud.)—chigger
Fannia canicularis (L.)—little house fly
Fannia scalaris (F.)—latrine fly
Latrodectus mactans (F.)—black widow spider
Liponyssus bacoti (Horst)—tropical rat mite
Lytta vesicatoria (L.)—Spanish-fly
Megalopyge crispata (Pack.) — crinkled flannel moth
Musca domestica L.—house fly
Musca vicina Macq.—oriental house fly
Muscina stabulans (Fall.)—false stable fly
Nygmia phaeorrhoea (Donov.) — brown-tail moth
Ornithodoros turicata (Dugès) — relapsing-fever tick
Pediculoides ventricosus Newp. — straw itch mite
Pediculus humanus corporis Deg.—body louse
Pediculus humanus humanus L.—head louse
Phobetron pithecium (A. & S.) — hag moth
Phormia regina (Meig.)—black blow fly
Phthirus pubis (L.)—crab louse
Pulex irritans L.—human flea
Rhipicephalus sanguineus (Latr.)—brown dog tick
Sarcoptes scabiei (Deg.)—itch mite
Scutigera cleoptrata (L.)—house centipede
Sibine stimulea (Clem.) — saddleback caterpillar
Simulium meridionale Riley—turkey gnat
Solenopsis geminata (F.)—fire ant
Solenopsis xyloni McCook—southern fire ant
Stomoxys calcitrans (L.)—stable fly
Tabanus atratus F.—black horse fly
Tabanus lineola F.—striped horse fly
Triatoma sanguisuga (Lec.) — bloodsucking conenose
Tunga penetrans (L.)—chigoe
Vespa crabro germana Christ — giant hornet
Wasmannia auropunctata (Roger)—little fire ant
Xenopsylla cheopis (Rothsch.) — oriental rat flea

OBSERVATIONS ON MOSQUITO AND MALARIA CONTROL IN THE CARIBBEAN AREA

PART II. BRITISH GUIANA

H. H. STAGE [1] AND GEORGE GIGLIOLI [2]

After leaving Suriname (Dutch Guiana), the senior author stopped at British Guiana to observe some of the mosquito and malaria problems in that colony.

There are probably few countries where malaria constitutes a more serious problem than in British Guiana. Both on the coast and in the interior, there is a high incidence of this devitalizing disease, and no doubt it is the main obstacle to development and progress. In a population of about 350,000 persons, malaria has accounted annually for an average of two deaths per 1,000 inhabitants. This is a poor index of the damage caused by the disease, as it does not take into account the much larger number of deaths caused indirectly by chronic and repeated malaria infections, such as anemia, nephritis, and prematurity and congenital debility in infants born to mothers afflicted with malaria. In the rural districts and in the city suburbs few children escape this infection. Dangerous convulsive forms of the disease are frequent.

In the interior only the aboriginal Indian builds his village on high ground, on sand or gravel. The immigrants—Negroes, Chinese, Portuguese, East Indians, and their mixtures—brought to the colony as slaves or as indentured laborers for the plantations, have settled on the alluvial coastland and on the densely forested, malarial mud flats which form the floor of the river valleys below the first rapids. Most of the inhabitants are exposed to the ravages of malaria throughout their lives, and they accept the disease as inevitable.

Malaria is by no means the only important mosquito-borne disease in British Guiana. Filariasis is a major problem in the cities and large villages, and yellow fever is always a potential danger because it has been recorded from the interior as jungle fever.

The diverse breeding habits of the mosquitoes which transmit these diseases—*Anopheles* spp., *Culex quinquefasciatus* Say, and *Aedes aegypti* (L.)—make the problem of mosquito control and mosquito-borne diseases a complex and difficult one.

In British Guiana, as in Dutch Guiana, the colony lives mainly by its agriculture, and in both countries the staple crops, rice and sugar cane, are dependent on extensive irrigation in spite of an annual rainfall in the neighborhood of 90 inches. There is a great difference, however, in the malaria rate of the two countries; this is proportionate to the degree of development of irrigation and wet cultivation. In Dutch Guiana there are only epidemic outbreaks of the disease along the coastal fringe, whereas in British Guiana the coastal malaria bears the same characters as the Dutch Guiana jungle malaria, high incidence and high rate of malignant tertian infections. In both Guianas *Anopheles darlingi* Root seems to be the principal culprit. This species is strictly a night flyer and extremely susceptible to desiccation; hence it confines itself largely to the low forests and similar sheltered, damp areas where the night air is saturated with moisture. The constant ocean breeze which blows along the

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Dutch and British Guiana coasts is inimical to its welfare, wherever the primitive coastal conditions have not been modified by the introduction of sea defenses, drainage, irrigation, and the planting of crops and trees offering suitable conditions of humid shelter.

The topography and agricultural practices in British Guiana are especially conducive to mosquito breeding. This is especially true in regard to anophelines. Much of the land behind the dikes along the coast is below high-tide sea level. Indeed, sea water, in some sections, finds its way inland for several miles. The cane and rice fields are blocked off and separated by ditches, which eventually drain toward the sea, where either pumps or tide gates empty them at a low tide. Irrigation canals are everywhere, and in no place can a person walk more than a few hundred feet in any direction without crossing one. The practice of flooding the fallow cane fields (Fig. 1) for six months to a year after three or four crops have been harvested also contributes to a bountiful crop of mosquitoes.

So far 15 species of *Anopheles* have been identified in British Guiana, but the malaria vector is *darlingi*. The species *albitarsis* Arrib, *aquasalis* Curry, *oswaldoi* (Pery.), and *triannulatus* (Neiva and Pinto) are all common, but essentially zoöphilous. They are found mainly in stables or on animals in the open, and infrequently bite man; when found in houses they are seldom engorged with blood. *A. darlingi,* however, bites man selectively and is found in houses in large numbers before and after biting.

On the coast *Anopheles darlingi* breeds mainly in fairly large bodies of fresh water, such as irrigation canals, rice fields, flooded cane fields, and pastures. In the interior it prefers white water as found in seepage swamps, in forest streams, or in rain-water collections. On the savannahs of the interior it occurs in white-water ponds, lakes, and streams mainly along the forested course of the larger

FIG. 1. Fallow cane fields are flooded for several months after three or four crops have been harvested. These fields produce anopheline mosquitoes in great numbers.

rivers. It is not found in the highly acid, brown, peaty waters so characteristic of the forest areas of the interior. In nature this species is rarely found in waters containing over 200 milligrams of sodium chloride per liter, but in the laboratory much higher concentrations are tolerated. *A. darlingi* is rarely found in waters with a pH under 5.5; the optimum range is 5.8 to 6.8. Salinity and acidity of surface waters therefore limit its distribution. The highly acid waters in the interior and the highly saline waters along the coast are important limiting factors.

Anopheles aquasalis and *A. oswaldoi,* on the other hand, can breed in sea water containing as much as 28 grams of sodium chloride per liter. In some of the higher savannahs on the Brazilian border, *albitarsis, strodei* Root, *aquasalis,* and *triannulatus* are widespread and very numerous. Apparently these are not efficient vectors, because malaria is not a severe problem where they and other anophelines except *darlingi* exist.

All the data collected from malaria surveys conducted during the last 10 years by the junior author, throughout the coastland from the Courantyne to the Pomeroon Rivers, indicate clearly that sea defenses, irrigation, and the cultivations they foster, when used without due discrimination between agricultural and residential lands, bring about the establishment of *Anopheles darlingi* and subsequently endemic malaria.

The Malaria Research Service, Medical Department, British Guiana, made the first practical demonstration in South America that the numbers of *Anopheles* mosquitoes and the incidence of malaria can be substantially reduced by applying DDT residual sprays (Fig. 2).[1] The preliminary experiments were initiated by C. B. Symes, A. B. Hadaway, and the junior author on January 28, 1945. These ex-

[1] The gasoline-motor gear pump used in these experiments was assembled and loaned by the Orlando, Florida, laboratory of the Bureau of Entomology and Plant Quarantine.

FIG. 2. In British Guiana homes occupied by laborers were first treated with DDT residual sprays on January 28, 1945.

periments have been continued and greatly expanded by the junior author with funds supplemented by the Colonial Development and Welfare Fund and the British Guiana Sugar Producers' Association. The results have been eminently successful. It now appears that the vicious, house-haunting, and very efficient vector of malaria, *Anopheles darlingi,* is in grave danger of extermination because of DDT and a new technique for applying it. DDT residual sprays are equally potent against *Aedes aegypti,* the carrier of yellow fever, and only slightly less toxic to *Culex quinquefasciatus,* the vector of filariasis.

During 1945 slightly more than 1,000 pounds of DDT were used. This amount was increased by 6,500 pounds the first half of 1946 and orders have been placed for 5½ tons more. The average total cost per 1,000 square feet of surface treated was slightly less than $1 (British Guiana). More than 20,000 persons were under DDT protection on June 30, 1946 and plans are under way to include an additional 55,000.

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NOTES ON PENNSYLVANIA MOSQUITOES

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In a recent article, Wilson, Barnes, and Fellton (1946) published a list of the mosquitoes known to occur in Pennsylvania as of that date, and indicated the localities at which each species had been found.

During the war, the writer was stationed for several months at Carlisle Barracks near Carlisle, Cumberland County, Pennsylvania, and although not engaged in mosquito survey or control work, he was able to make a few collections of the insects. The notes which follow are a result of these collections. Of the mosquitoes listed all but *Megarhinus septentrionalis* Dyar & Knab have been previously recorded from the state, but new locality records are given for several species.

Most of the species listed were collected in a camping area located some eight miles north and west of Carlisle. This is not intended as a complete list of mosquitoes occurring in this region, but includes only those species that were collected and which were identified with certainty. General data are included for each species, and the date of collection, if

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FIG. 1. Mosquitoes can develop from egg to adult in a week or ten days.

The young (or larvae) of mosquitoes develop in standing water, but must come to the surface every few minutes for air. Here they may be killed by a film of oil (20 to 50 gallons per acre) or other poisons applied to the surface of the water.

Adult mosquitoes, also, can be killed by properly formulated and properly applied sprays or fogs.

Many thousands of gallons of oil, and of oil solutions or emulsions of Pyrethrum, DDT, and the like, are used in the control of mosquitoes and related pests. Storage space must be provided for such materials. Photo by courtesy of C. T. Williamson.

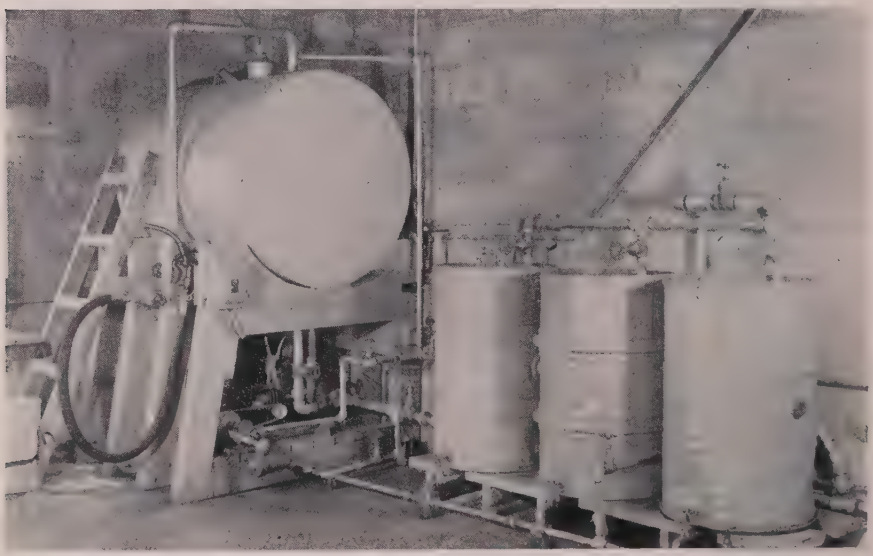

FIG. 2. Mechanical mixing equipment must be used to prepare the huge quantities of special oil solutions, emulsions, and the like, that are required to control mosquitoes under different conditions.

Here several different formulas can be mixed and stored, pumping the ingredients from outdoor storage tanks and returning the finished fromulas to outdoor tanks for storage until required for use. Photo by courtesy of C. T. Williamson.

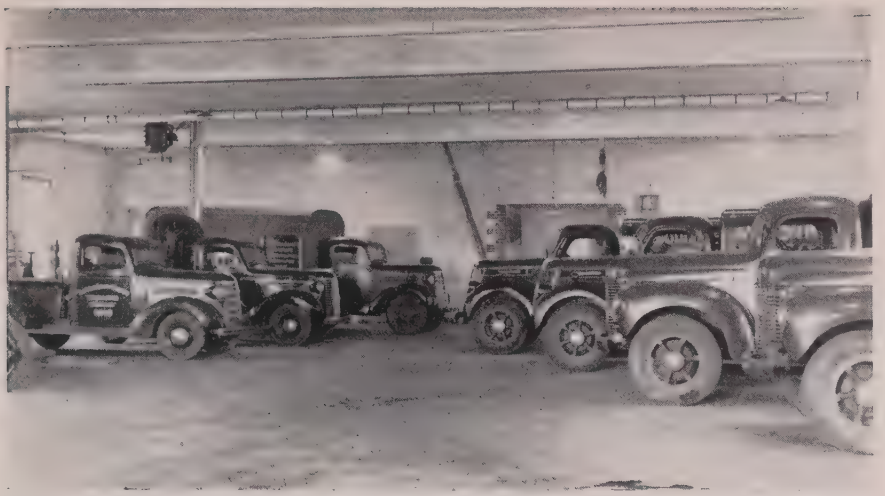

FIG. 3. Mosquito oil and stock larvicide are delivered to supply stations for use of work parties by large tank trucks, or in drums delivered by smaller service trucks.
Photo by courtesy of C. T. Williamson.

FIG. 4. Well tooled machine shops must be maintained to service mechanized equipment.
Photo by courtesy of C. T. Williamson.

FIG. 5. This 45 foot power boat, one of two boats belonging to the Suffolk County (Long Island) Mosquito Control Commission, carries men, and tows barges loaded with equipment and supplies to otherwise inaccessible work areas. Photo by courtesy of C. T. Williamson.

FIG. 6. During the summer of 1945, 15,000 acres of mosquito-breeding salt marsh in Suffolk County, Long Island, were sprayed 4 times experimentally from the air with an oil solution of DDT for control of mosquitoes in the adult stage. During the summer of 1946, nearly 80,000 acres were sprayed 5 times in the same manner. Photo by courtesy of C. T. Williamson.

Fig. 7. Bousch Creek drainage project for removal of mosquito breeding standing water. Norfolk, Virginia. Placing and driving piling for 1,400 feet of a 24 foot canal through an area of hydraulic fill. Photo by courtesy of Perry W. Ruth.

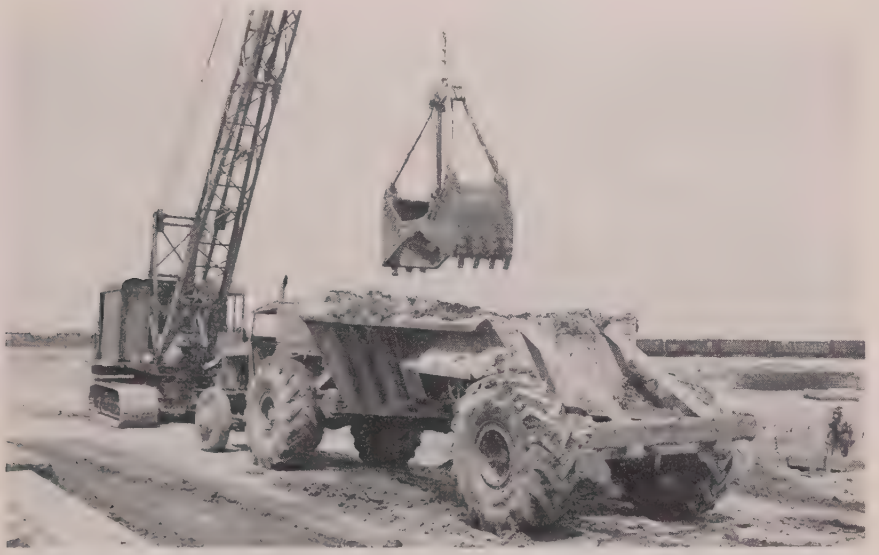

Fig. 8. Bousch Creek drainage project for removal of mosquito breeding standing water, Norfolk, Virginia. Excavating spoil from between walls of sheet piling, to make a 24 foot canal 1,400 feet long through an area of hydraulic fill, after which the concrete floor of the canal is poured, and the wooden bracing removed. Photo by courtesy of Perry W. Ruth.

FIG. 9. A ¾ yard drag-line bucket operating from a caterpillar crane equipped with a 40 foot boom. Cape May County, New Jersey. Photo by courtesy of T. D. Mulhern.

FIG. 10. A ½ yard clam-shell shovel operating from a crane mounted on a scow, and equipped with a 40 foot boom. Inter-county upland mosquito control project, Morris County, New Jersey. Photo by courtesy of T. D. Mulhern.

Fig. 11. Morris Creek (Connecticut) reinforced concrete tide-gate installation. To permit the gravity outflow of storm water from, and prevent or regulate the inflow of tidal water upon a diked salt meadow. Such control is often necessary to keep sewage polluted water in definite channels, and to prevent its periodic spreading over the entire marsh with inflowing tidal water.
Photo by courtesy of T. D. Mulhern.

Fig. 12. Installing a huge reinforced concrete culvert in a mosquito control drainage project.
Photo by courtesy of T. D. Mulhern.

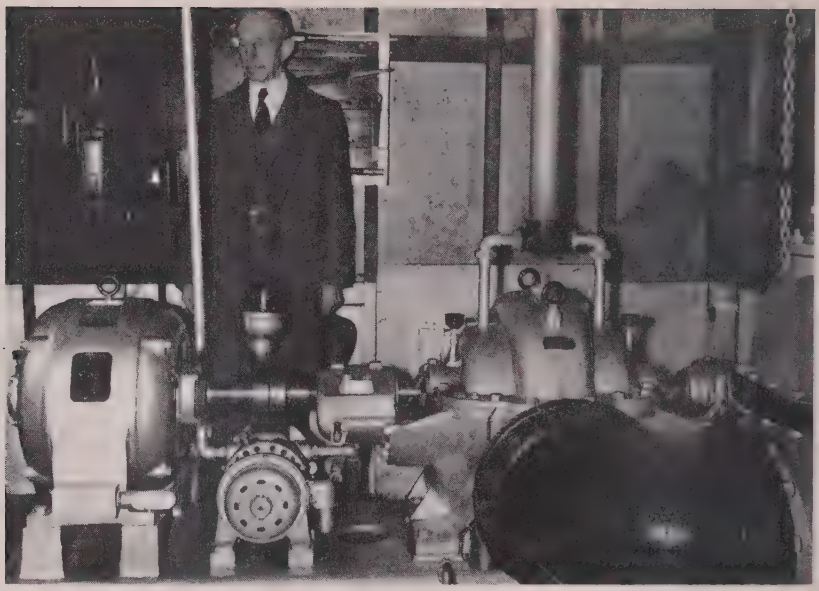

FIG. 13. Where a diked salt marsh has too little elevation for tide-gate controlled gravity drainage, the mosquito-breeding and often sewage-polluted water must be removed by automatic pumping installations like that shown here. Photo by courtesy of T. D. Mulhern.

FIG. 14. Millions of mosquito breeding and mosquito harboring municipal catch basins must be sprayed at frequent intervals during the summer months. Photo by courtesy of T. D. Mulhern.

such a record was made. The writer was assisted in some of this work by Dr. Mortimer I. Benioff. The species are arranged alphabetically.

Aedes triseriatus (Say). Several adults trying to bite, and a few larvae and pupae from a tree hole, September 8, 1945.

Aedes trivittatus (Coquillett). Two females collected October 10, 1945, trying to bite.

Aedes vexans (Meigen). Many larvae and pupae in woodland pool, August 10, 1945. Emerged as adults in the laboratory.

Anopheles punctipennis (Say). Large numbers of this anopheline were collected both as larvae and as adults in August, 1945. Larvae were found in ruts, pools and grassy streams, while adults were collected under bridges, in barns and other outhouses. This species has previously been recorded from Carlisle (Wilson et al. 1946).

Anopheles quadrimaculatus Say. One female found under bridge, September 6, 1945.

Culex pipiens Linnaeus. Large numbers of larvae and some adults collected during August 1944. Previously recorded from Carlisle (Wilson et al. 1946).

Culex restuans Theobald. Larvae found in woodland pool, August 4, 1944. Previously reported from Carlisle (Wilson et. al. 1946).

Culex salinarius Coquillett. Larvae found in woodland pool, August 4, 1944. Previously recorded from Carlisle (Wilson et. al. 1946).

Culiseta inornata (Williston). Two females under bridge, September 7, 1945.

Megarhinus septentrionalis Dyar & Knab. One second or third instar larva of this species collected from a tree hole. This specimen was reared by feeding with *Aedes aegypti* larvae from a colony the writer was maintaining in the laboratory. It emerged as an adult male.

So far as could be determined, this is the first record of this species from Pennsylvania.

Orthopodomyia signifera (Coquillett). Several larvae collected in tree hole, October 1, 1945. These emerged in the laboratory as adults several days later.

Psorophora ferox (Humboldt). Several females collected trying to bite, September 7, 1945. On the basis of this collection and other incidental observations, the writer does not believe that this species is as "extremely rare" is some parts of the state as previously thought (Wilson et. al. 1946).

Psorophora ciliata (Fabricius). One larva brought into the laboratory for identification. This specimen later emerged as an adult female.

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A LIST OF THE MOSQUITOES OF JAMAICA, BRITISH WEST INDIES

GEORGE A. THOMPSON

Senior Assistant Sanitarian (R)
Communicable Disease Center Activities U. S. Public Health Service

Previous lists of mosquitoes of the Island of Jamaica have been published by Theobald and Grabham (1), C. W. Johnson (2), and Gowdey (3). In these works a total of 37 species are reported. Of this number four are not now known to occur on the Island. The present list includes 52 species, of which two are undescribed and another is renamed. The new records here given are principally those of recent collections made by Dr. R. G. Hill of Rockefeller Foundation and Dr. Harry D. Pratt, Col. W. H. W. Komp, and the writer, all of the U. S. Public Health Service. Extensive work on the mosquitoes of the Island is now being conducted by Dr. Hill and it is quite possible that additional species will be discovered.

LIST OF MOSQUITOES OF JAMAICA WITH SYNONOMY *

ANOPHELES

albimanus Wiedeman 1, 2, 3, 4, 5, 7, (The following synonomy applies to Jamaica collections only in the references cited.)
albitarsis Robineau-Desvoidy 1
Cellia argyrotarsis Robineau-Desvoidy 1, 2, 4
Cellia albipes Theobald 1
Cellia argyrotarsis albipes Theobald 1, 2, 3
atropos Dyar & Knab 5, Little Goat Island, Light Trap June 1945, G. A. Thompson coll.
cruciaris Wiedemann 2, 3, 4, 5
**grabhamii* (Theobald) 1, 2, 3, 4, 5, 7
vestitipennis Dyar & Knab 2, 3, 4, 5, 7

AEDES

aegypti (Linnaeus) 3, 5, 7
argenteus (Poiret) 2
fasciata (Fabricius) 1, 9
**inequalis* (Grabham) 2, 3, 4, 5, 7, 15
**aureostriata* (Grabham) 2, 3, 4, 5, 7, 9
**aurites* (Theobald) 2, 3, 4, 5, 7
mediovittatus (Coquillett) 2, 3, 4, 5, 7
**uncatus* (Grabham) 8
nubilus Theobald 4, 5, 7, 10
**pertinax* (Grabham) 2, 10
scapularis (Rondani) 2, 3, 4, 5, 7
Culex confirmatus Theobald 1, 8
sollicitans Walker 1, 2, 3, 4, 5, 7
taeniorhynchus Wiedeman 1, 3, 4, 5, 7
niger (Giles) 2
**tortilis* Theobald 1, 2, 3, 4, 5, 7
**auratus* Grabham 10
**walkeri* Theobald 1, 2, 3, 4, 5, 7, 9
*Undescribed species Clarendon, Bromeliads, July 1945, G. A. Thompson coll.

CULEX

aikeni Aiken Clarendon, Light Trap, Feb. 1945, G. A. Thompson coll.
americanus (Neveu-Lemaire) 5
**atratus* Theobald 1, 2, 3, 4, 5, 7
bahamensis Dyar & Knab 5, Little Goat Island, Light Trap, June 1945, G. A. Thompson coll.
chidesteri Dyar 5
corniger Theobald 2, 3, 4, 5
**hassardi* Grabham 9
lactatus Dyar & Knab 10
subfuscus Theobald 2
erraticus Dyar & Knab (Clarendon, Feb. 1945, G. A. Thompson and H. D. Pratt coll.)
flabellifer Komp 5
inhibitator Dyar & Knab 3, 4, 5
atratus Theobald (in part)
**janitor* Theobald 1, 2, 3, 4, 5
nigripalpus Theobald 3, 4, 5, 7, 8
**similis* Theobald 1, 2
**microsquamosus* (Grabham) 2, 8
**macrosquamosa* (Grabham) 3
pilosus Dyar & Knab 2, 3, 4, 5, 6, 7, 10
reductor Dyar & Knab 2, 3
**Mochlostryax jamaicensis* Grabham 3, 10
quinquefasciatus Say 2, 5, 7
fatigans Wiedemann 1, 9
revocator Dyar & Knab
**secutor* Theobald 1, 2, 3, 4, 5, 9, Hardware Gap, Blue Mts., Feb. 1946, G. A. Thompson and W. H. W. Komp coll.
quasisecutor Theobald 11
taeniopus Dyar & Knab 3, 4, 5
**Melanoconion annulipes* Theobald 2

DEINOCERITES

**cancer* Theobald 1, 2, 3, 4, 5, Little Goat Island, Light Trap, June 1945, G. A. Thompson coll.

* An asterisk indicates species or synonyms for which Jamaica is the type locality. Numbers following names refer to references cited.

HAEMOGOGUS

**equinus* Theobald 1, 2, 3, 4, 5

MANSONIA

indubitans Dyar & Shannon 5, Clarendon, Light Trap, Jan. 1945, G. A. Thompson coll.

nigricans (Coquillett) 5, Clarendon, Light Trap, Feb. 1945, G. A. Thompson coll.

titillans (Walker) 1, 2, 3, 4, 5, Clarendon, Light Trap, Jan. 1945, G. A. Thompson coll.

MEGARHINUS

portoricensis Roeder 5

ORTHOPODOMYIA

signifera (Coquillett) 3, 4, 5, 7

**Mansonia waverleyi* Grabham 2

PSOROPHORA

confinnis Lynch Arribalzaga 3, 5, 7

**jamaicensis* Theobald 1, 2, 4

**walsinghami* Theobald 12

ferox (Humboldt) 3, 5, 7

posticatus Wiedemann 2

**Janthinosoma echinata* Grabham 10

infinis Dyar & Knab 5

**johnstonii* Grabham 2, 3, 5, 7, 8

**pygmaea* Theobald 1, 2, 3, 4, 5, 7

URANOTAENIA

lowii Theobald, 1, 2, 3, 4, 5, 7, 8

sapphirina (Osten-Sacken) 4, 5, 7, 8

**socialis* Theobald 1, 2, 8

WYEOMYIA

caracula Dyar & Nunèz-Tovar 14

**hirsuta* (Hill & Hill)

**Phoniomyia hirsuta* Hill & Hill 13, 16

**mitchellii* Theobald 1, 2, 3, 4, 5, 7

**Dendromyia mitchellii* Theobald 1

pampithes Dyar & Nunèz-Tovar 5

pertinans (Williston) 5, 7

**grayii* Theobald 1, 2, 3

vanduzeei Dyar & Knab 5

*Undescribed species Hardware Gap above 5,000 feet in Bromeliads, Jan. 1946. G. A. Thompson and W. H. W. Komp

Identifications of all specimens in the above list collected by the writer (7) have been verified by Dr. Alan Stone of the U. S. National Museum, by Colonel Komp, or by Captain Pratt. With the exception of *Culex aikenii,* specimens of all species recorded from Jamaica for the first time have been deposited in the U. S. National Museum, Washington, D. C. Only a single specimen of *aikenii* was collected, and it is in the collection of Colonel Komp.

Aedes aureostriata (Grabham) has long been considered to be a synonym of *A. aurites* (Theobald). However, on close examination of the literature it appears that both *aureostriata* and *aurites* are synonyms of *A. inequalis* (Grabham). The complete synonymy for this species will appear in a forthcoming paper. The records of *Culex taeniopus* D. & K. are based on females only.

The four species of mosquitoes reported by previous authors but which probably do not occur on the Island, are *Anopheles punctipennis* Say, *A. maculipes* (Theobald), *Culex macrosquamosa* (Grabham), and *Psorophora haruspicus* (D. & K.). Theobald's record (1) of *Anopheles punctipennis* has previously been questioned by Dyar and Knab (11) and his record of *A. maculipes* is believed to be questionable since it was based on female specimens only. The record of *Culex macrosquamosa* (Grabham) reported by Gowdey (3) is clearly a *lapsus calami* since the species indicated in the reference cited is *C. microsquamosus* (Grabham). The original record of *Psorophora insularia* (D. & K.) reverts to that by Grabham of *P. haruspicus* (D. & K.) made in 1906. This species has not since been found.

Acknowledgments

The writer wishes to express his gratitude to Dr. R. B. Hill of the Rockefeller Foundation for free access given to his collection and records; to Captain H. D. Pratt for his assistance and encouragement; to Mr. C. Bernard Lewis, Curator, Jamaica Institute, Kingston, Jamaica, B.W.I., for his cooperation; to Major Porter A. Stephens for his suggestions; and to Colonel W. H. W. Komp and Colonel G. H. Bradley for reviewing the paper.

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NEWS AND NOTES

THE HIGHEST INDEX OF *Aedes* MOSQUITO BREEDING EVER RECORDED IN HONOLULU was noted in December. A dengue breeding index of 8.3 per cent was reported from inspections totaling approximately 12,000. This is three times the normal monthly index. Bottles, tin cans, jars, and automobile tires were the worst offenders, according to Dr. David Bonnet, acting chief of the Mosquito Control Division.—The Hawaii Health Messenger, February, 1947, 6(8):1. H. H. S.

MEDICAL EXPERIMENTS ON HUMAN BEINGS IN CONCENTRATION CAMPS IN NAZI GERMANY. The present trials of many German doctors and medical administrators before military Tribunal I of the United States of America at Nuremberg has drawn public attention to the vast number of human experiments, which were carried out on prisoners in concentration camps. At Dachau early in 1946, Dr. Klaus Karl Schilling, the eminent malariologist, was hanged for his part in experiments in which some 1,200 prisoners were infected with malaria.

He had a greater claim than most of the experimenters to the title of scientist. He went to Dachau on the invitation of Himmler to carry out experiments in malaria, on which subject he was a well-known authority (he had been a member of the League of Nations Malaria Commission). He was over 70 when these experiments were carried out. Believing that the experiments would provide an unequalled opportunity for the advancement of malariology he used a wide strain of benign tertian malaria which would be unlikely to prove fatal in healthy individuals, and he himself appears always to have administered drugs carefully and scientifically. He is said usually to have obtained the consent of the prisoners before he infected them, but at Dachau this could not amount to very much. He was accused at a trial held by the U. S. authorities of having caused many deaths. The Court took the view that "although Dr. Schilling's motive may have been sincere and purely a scientific one, his activities exemplified the Nazi schema which existed at Dachau. The part he played in that schema is clear."—K. MELLANBY, British Medical Journal No. 4490:148, 1947.

CENTERS OF MALARIA RESEARCH. According to the editor of the Journal of the National Malaria Society the Committee on Medical Research are making a survey of malaria research being carried on in this country and abroad. The September and December numbers (1946) of The Journal have given brief information on some of these centers of research. Others will be given as they become available. The following localities have been given:

1. Emory University, Atlanta, Georgia.
2. Naval Medical Research Center, Bethesda, Maryland.
3. University of Chicago, Chicago, Illinois.
4. School of Tropical Medicine, Calcutta, India.
5. New York University, Goldwater Memorial Hospital, Welfare Island, New York.
6. School of Medicine, University of Texas, Galveston, Texas.
7. Tennessee Valley Authority, Wilson Dam, Alabama.
8. The Public Health Research Institute of the City of New York, New York City, N. Y.
9. Columbia University, College of Physicians and Surgeons, New York City, N. Y.
10. Central Research Institute, Kasauli, India.
11. American Cyanamid Company, Stamford, Connecticut.
12. Station for Malaria Research (Florida State Health Department), Rockefeller Foundation, Tallahassee, Florida.
13. University of North Carolina, School of Medicine, Chapel Hill, North Carolina.

H. H. S.

THE HOWARD-KRAUSS SOCIETY OF SOUTH SIDE HIGH SCHOOL, MEMPHIS, TENN. ("Educate to Eradicate Malaria"), has contributed the following:

February 25, 1947

Dear Mr. Mulhern:

Enclosed you will find a check to renew our subscription for the MOSQUITO NEWS. This magazine is a vital part of our mosquito control library and we look forward to each quarterly issue.

This year, Mr. J. A. LaPrince has visited our school a number of times. He always encourages Howard-Krauss members. To mark our tenth year we now have an official pin which means much to us, as it symbolizes the work of our Howard-Krauss educational program.

In November, 1946, we gave the 19th performance of "The Quarreling of the Quad," our latest mosquito control play. We are quite proud of this play and we only wish there were a magic carpet to sweep us away to New Jersey to give it for you.

We wish you and all our friends who will meet in April at the thirty-fourth annual meeting—good luck and a great meeting.

Sincerely yours,

(Signed) Ruth Katrovitz
Corresponding Secretary
Senior Howard-Krauss Society

April 11, 1947

Dear Mr. Mulhern:

We received your letter of March 11 and appreciate the interest you have shown in us. It is always a pleasure to hear from you.

In answer to your request, we are sending you a brief summary of our play, "Quarreling With the Quad," along with an account of the various times the cast has presented the play.

We are also sending a cut which appeared in the "Commercial Appeal" last December, which we thought might me of some use to you. We would, however, like to have the cut back at your convenience.

We thank you again for your interest in our society.

Very sincerely yours,
Howard-Krauss Society
Barbara Ball
Corresponding Secretary

Quarreling With the Quad

(Eighteen Performances Given in a Year)

"Quarreling With the Quad," a one-act play by Charles Edwards, won first prize in the Howard-Krauss Society's 1946 Malaria-Control Play-Writing Contest. Two casts of Howard-Krauss members have given eighteen performances of the play.

The first performance was given April 4, 1946, as the feature number on the Howard-Krauss Program, for the entire South Side High School student body. Present, as guests, for this program were Col. J. A. LePrince, Col. H. A. Johnson, U.S.P.H.S., Mr. L. W. Murphy, Memphis and Shelby County Health Department, and nine malaria-control educators from Arkansas.

The second performance of "Quarreling With the Quad" was presented at the May, 1946, meeting of the Memphis and Shelby County Engineers Club.

At the request of Dr. T. T. Ross, State Health Officer of Arkansas, the cast took the play in May, 1946, to eleven counties in Eastern Arkansas,

giving fourteen performances during a four days' tour.

In the fall, a second cast presented the play before the Memphis Medical Auxiliary and before the Millington High School student body.

Characters of the play are as follows:

Abigail: A farmer's wife, forty-five years old, uneducated, and shiftless.

Pansay: Another farmer's wife, forty years of age, another ignorant and careless woman.

Quad, or *Anopheles quadrimaculatus,* the malaria mosquito.

The scene opens in the yard of Abigail's run-down home. The two friends, Abigail and Pansay, talk a few minutes and then fall asleep.

In a dream, the Quad appears and introduces herself. She then acquaints the two women with how she carries malaria to humans and with the significance of malaria in a community. She takes advantage of their ignorance, and taunts them with their lack of intelligence in ways of preventing and eliminating malaria.

Awakening from their dream, the women prove to be more than just hopeless do-nothings. They determine to learn more about malaria-control, to use what they learn to help themselves and their community.

INSECTICIDE RESEARCH AND DEVELOPMENT IN THE UNITED KINGDOM. Last summer action was taken in Great Britain to greatly reduce the wartime organization dealing with insecticide problems and to set up a new permanent organization under the auspices of the Agricultural Research Council.

These actions resulted in the dissolution of the Insecticide Development Panel of the Ministry of Production and the Insecticide Applications Committee of the Ministry of Supply and the establishment of the Insecticide Standing Conference and the Research and Development Coordinating Committee on Insecticides. The former is to coordinate action in expressing user needs and priorities and producer difficulties to the Research and Development Coordinating Committee and in securing development and application of results of research. The Research and Development Coordinating Committee on Insecticides is to analyze the problems to be dealt with, make recommendations for necessary action and keep the Standing Conference informed as to progress in the insecticide field.

Certain interdepartmental committees will be continued whose functions involve fields beyond insecticides such as those concerned with locust control, midge control and the Consultative Committee on Insecticide Materials of Vegetable Origin. F. C. BISHOPP

DR. RICHARD H. DAGGY, formerly assistant professor of entomology at the University of Minnesota, has accepted a position as medical entomologist for the Arabian American Oil Company in Saudi Arabia. He will work in malaria mosquito control and allied medico-entomological problems. His new mailing address: Arabian American Oil Company, Dhahran, Saudi Arabia.

DR. E. H. HINMAN, recently elected to active membership in the American Mosquito Control Association, is President-elect of the National Malaria Society. H. L. T.

MR. HARRY STAGE was recently the recipient of a special promotion for meritorious service. This recognition, which is awarded to comparatively few workers, came, incidentally, on his birthday. We are all pleased to know that his diligence during the arduous war years and his contributions to the knowledge of insect control have been thus recognized. H. L. T.

INTER-AMERICAN SANITARY ENGINEERING CONFERENCE, SANTIAGO, CHILE. Word has been recently received from Santiago, Chile, that the Third Inter-American Sanitary Engineering Conference will take place there from November 20 to 27 this year. The Inter-American Association of Sanitary Engineering and the Institute of Engineers of Chile are collaborating on arrangements for the meeting to which are invited all sanitary engineers, civil and hydraulic engineers, sanitary chemists, public health officials and others engaged in sanitation activities in the Western Hemisphere.

The recently formed Chilean Section of the Inter-American Sanitary Engineering Association is in charge of the conference details and has announced the general plans which include inspection trips to Santiago's water treatment plant and the Villa Alemana sewage treatment plant. A large list of technical papers on water supply, sewage treatment, malaria control and rural sanitation will be presented during the course of the meeting. Manufacturers' exhibits will again play a prominent part at the conference. One of the more interesting sidelights will be a trip to Vina del Mar, the famous Chilean ocean resort.

Final action will be taken at the meeting on the Association's constitution, jointly prepared and approved by the Rio de Janeiro, Brazil, and Caracas, Venzuela, Regional Conferences last year. The duties of the Interim Committee which has been functioning up until now will be taken over by the Permanent Organization consisting of a board of directors of 21 members.

The Chilean Conference Committee is headed by Ruperto Casaneuva who is being assisted by Eduardo Aguirre S., Jorge Von Bennewitz, Luis Valenzuela, Adolfo Acevedo D., and J. Carter Hanes. United States participation in the conference is being coordinated by Mr. C. I. Sterling, Jr., Institute of Inter-American Affairs, Washington, D. C.

Further information may be secured by writing The Secretary, Inter-American Association of Sanitary Engineering, N.W. Corner, 17th and Constitution Ave., Washington 6, D. C.

EDITORIAL SECTION

S.O.S.! MEMBER COOPERATION NEEDED!

Help Promote the Sale of Advertising Space in Mosquito News

MOSQUITO CONTROL IS BIG BUSINESS! SAY SO WHERE IT WILL COUNT!

MOSQUITO NEWS needs more money with which to expand its services to the Association.

With the present number you have received a prospectus designed to promote the sale of advertising space in MOSQUITO NEWS, by directing the attention of manufacturers, distributors, and suppliers to the fact that *"Mosquito Control is Big Business"* with annual budgets aggregating many millions of dollars, using huge quantities of machinery, equipment and supplies, and with the individual budgets of many County mosquito control commissions and similar agencies ranging from $50,000.00 to $150,000.00 and more; and directing attention to the related fact that MOSQUITO NEWS is an attractive special-field advertising medium.

When you are contemplating the purchase of equipment, materials and supplies of any kind, you can help to increase the resources and thus the usefulness of MOSQUITO NEWS, and you may be doing the prospective supplier a favor if you will send him a copy of this enclosed prospectus, with a statement that, other things being equal, members of the Association prefer to buy from advertisers in MOSQUITO NEWS, and asking whether its merits as a special-field advertising medium have ever been brought to your correspondent's attention.

The enclosed prospectus was prepared for use by our advertising manager, and extra copies will be available if you can use them.

In spite of the continuous, and recent remarkable growth of the American Mosquito Control Association, its income from dues and from non-member subscriptions still carries only a little more than half of the cost of publishing MOSQUITO NEWS. The remainder of the cost of publication has been covered by income from the sale of advertising space and any immediate increase in the services rendered by MOSQUITO NEWS must come through added income from this source.

With publication costs so high, we are actually selling MOSQUITO NEWS for less than it costs to print and distribute it.

This is particularly true in the case of our foreign associate members, who pay only the same $2.50 dues that are paid by members residing in the United States; where, with most societies and most periodicals, foreign memberships and foreign subscriptions carry a higher rate than that prescribed for American members and subscribers.

Yet we ought to print twice as many pages, or change from a quarterly to a bi-monthly periodical, if we are to accommodate all of the valuable papers now seeking publication in MOSQUITO NEWS that would be of outstanding usefulness to our members.

We are in urgent need of some rather prompt policy-making action to meet this need of expanded services, and the associated need of added income; but there is much that our members individually can do now to help the situation, for added income will mean more pages in MOSQUITO NEWS.

MOSQUITO NEWS is one of the "fixed income" victims of the current inflation spiral; and continued advances in printing costs must soon result in a dangerously low margin of working capital, or in some curtailment of services.

Even now we would be sunk financially if it were not for our income from the sale of advertising space; and in any case, we must exert ourselves to increase this source of income.

In the interest of increased service to our members on the one hand, and of financial stability on the other hand, we should study the pros and cons of two alternative courses of action:

1. We might raise the question of reconsidering our classes of membership, our schedule of dues, and our practice with reference to foreign memberships, postage and the like.

However, our Association owes much of its present significance and value to its growing hemispheric, and general international exchange of information and ideas; but rates of exchange already place a serious handicap on foreign membership, and any further handicap of increased dues should be avoided if possible.

2. We might consider the possibility of a still larger increase in our income from the sale of advertising space.

Personally, the editor would like to see membership in the Association, including subscription to MOSQUITO NEWS (except honorary membership, of course), reduced to one class of membership, active only, with a flat rate for dues and subscription for both domestic and foreign members of $3.00, or $2.50, or even $2.00, and with no additional charge for postage on foreign subscriptions.

This, however, would continue and increase the burden imposed by our policy of subsidizing MOSQUITO NEWS, including an *extra* subsidy in the case of foreign memberships and foreign subscriptions. It would require a substantial increase of income from some source other than from dues.

If it were possible to finance such a policy, it could be made to contribute hugely to promote in increased measure, both intra-national and international acquaintanceship, understanding, and cooperation among THOSE WHO ARE CONCERNED WITH, OR INTERESTED IN THE *STUDY* AND *CONTROL* OF MOSQUITOES AND OTHER ARTHROPODS WHICH CAUSE OR CARRY DISEASE, AND OF THE DISEASES THEY CAUSE OR CARRY.

Such a policy *could* be made possible; but only under special conditions, which must depend upon full cooperation of our members;

1. By the suggested very comprehensive extension of the Association, a sufficiently large membership could be brought together to make such a project financially workable.

2. A large Association would be required, because a much larger income from the sale of advertising space would be needed to finance such a policy from income.

3. By bringing together a large enough Association to maintain a guaranteed circulation of 2,000 or more, we might hope to sell enough advertising space to support the policy of subsidizing our subscription rate on the sale indicated, and at the same time permit expansion of MOSQUITO NEWS adequately to serve all of the special interests that would be brought together in such an expanded Association.

In addition to its national and international implications, such an expanded Association, and particularly such an expanded MOSQUITO NEWS, could be made immensely helpful, through serving as a medium for bringing about a more completely coordinated mutual understanding of each other's problems and services, as between field and laboratory workers; between pest mosquito control, and malaria control workers; and between medical and non-medical workers concerned with the study and control of mosquitoes and other arthropods that cause or carry disease, and of the diseases they cause or carry.

Indeed, such an Association should help to minimize many of the present artificial, sometimes controversial, and always futile, lines of demarcation between

special provinces, prerogatives, and services in this general field.

As already indicated, these highly desirable things could be brought about without increasing dues, and possibly even with a decrease of dues, if we can sell enough advertising space, either in MOSQUITO NEWS as it is, or in the expanded MOSQUITO NEWS of an expanded Association.

Saturday Evening Post costs several dollars a copy to produce, but for many years was sold for 5 cents a copy. The 5 cent price sold several million-odd copies of each number. The several million circulation, in turn, sold enough advertising space to pay the difference between the 5 cent selling price and the actual cost per copy, and left a margin for profit on the operation.

Publication of MOSQUITO NEWS, in its small way, and in its special field, is a comparable proposition; and could profit from a study of the question why some periodicals can "make ends meet", and why some "fold up".

Not long ago, *Saturday Evening Post* increased its selling price to 10 cents a copy to help meet increasing publication costs. Before increasing costs to our members likewise, however, MOSQUITO NEWS should explore thoroughly the possibilities of increasing our resources from increased sales of advertising space.

If our members will individually focus a little more of their imagination upon the problems outlined here, and contribute a bit of work from time to time, we can make anything we like of the Association and of MOSQUITO NEWS.

Our experience so far has shown abundantly that our Association personnel has "what it takes" to do just this; but such things don't happen of themselves.

In your solicitation of advertising in MOSQUITO NEWS from manufacturers and suppliers, you may be sure that you have something valuable to sell; and, as an Association, we must exert ourselves to win from manufacturers, distributors and suppliers, recognition of MOSQUITO NEWS as a highly desirable, special-field advertising medium.

To accomplish this, as members of the Association, we must all exert ourselves to bring MOSQUITO NEWS to the attention of potentially interested advertisers, and we must exert ourselves to make it unquestionably a profitable advertising medium from the standpoint of our advertisers themselves.

Not only will added income from the increased sale of advertising space make possible a larger and more useful MOSQUITO NEWS, but it will be to the advantage of Association members to have brought together in one place, for convenient reference by executives and purchasing agents of Mosquito Control Commissions and others, information about available equipment, materials and supplies relating to a substantial portion of their requirements.

REVIEWS AND ABSTRACTS

On behalf of the Association, I wish to thank our collaborators who have so kindly translated abstracts and reviews into Spanish. H.L.T.

PRACTICAL MALARIOLOGY. By Paul F. Russell, Luther S. West and Reginald D. Manwell. 683 pp., 238 illus. W. B. Saunders Co., 1946. In "Practical Malariology," prepared under the auspices of the Division of Medical Sciences of the National Research Council, the authors have made readily available to the world much of the new information on malaria and its control and have sifted the wheat from the chaff among the older works.

In thumbing through the pages one is struck at once with the excellent paper, topography, illustrations and the convenient and logical topical arrangement with an abundance of headings that greatly aid in the quick finding of desired information. Following the foreword of Dr. Raymond Fosdick and the preface and acknowledgments, a concise historical account by periods is presented of the development of our knowledge of malaria. The remainder of the 648 pages is divided into six sections, an appendix and index.

Section I deals with the host range, life cycle, morphology and physiology of the Plasmodia, laboratory and field techniques. The development of a number of the Plasmodia is well illustrated with 14 plates, five of which are in colors. Extremely useful tables are included comparing the Plasmodia of man, monkeys, reptiles and amphibians. Section II deals with the mosquito; its morphology, taxonomy, life cycle, bionomics, distribution, field and laboratory techniques. A convenient feature of this section is the tabulated information, by regions, on the range and larval habitats of the several malaria vectors. In Section III the pathology, clinical aspects, and the treatment of malaria in man are dealt with. Immunity, latency and relapse are authoritatively presented and attention is given to various aspects of blackwater fever.

In Section IV the epidemiology of malaria is presented followed by a discussion of climatological factors influencing *Anopheles* abundance and malaria incidence, and the conduct and interpretation of malaria surveys. The reviewer feels that the authors in their consideration of malaria surveys unduly subordinate the study of the habits of adult *Anopheles* mosquitoes and especially their relation to the habitations of man. After all it is the direct mosquito-man relation that produces malaria and the house index means much. Such indexes should be based on day time collections of mosquitoes, all night observations, and collections in typical dwellings.

Section V on prophylaxis and control is of special interest and value to the entomologist and public health worker. In the short discussion of drug prophylaxis, the authors sum up the situation in that field as follows:

"But with regard to the eradication of malaria in malarious communities by chemoprophylaxis it may be stated definitely and clearly that: (1) in spite of many attempts, this has never been accomplished; (2) nothing in the record leads one to hope that this ever could be realized with drugs now available; (3) except in times of an epidemic, the results achieved by mass therapy in malarious populations are usually not worth the effort or the cost; (4) attempts at mass prophylaxis by drugs may do more harm than good by delaying more helpful antimosquito measures."

Chapter 22 of this section, containing 17 pages, is devoted to mosquito larvicides and methods of preparing and applying them. Various types of drainage are briefly discussed in the next chapter and some indication is given of the place of use and limitations of these. A number of other methods of controlling *Anopheles* mosquito breeding through the use of natural enemies, control of sunlight, and water manipulation are given appropriate consideration.

In discussing the control of adult mosquitoes it does not seem to the reviewer that residual spray treatment with DDT is given attention in proportion to its importance. It is also noted that not one of the numerous articles dealing with the results of the pioneer research in this field and in the extensive testing of repellents reported by the Orlando laboratory of the Bureau of Entomology and Plant Quarantine is cited in the bibliographic references, despite the fact that their formulas and procedures are closely followed. The absence of any reference to the use of water dispersible DDT as a residual spray is unfortunate.

The discussion of spray equipment is inadequate to guide workers in choosing equipment for residual spraying, a method destined largely to displace space spraying in large scale operations. The total absence of any discussion of thermal and exhaust aerosol equipment and of recently developed devices for aerial application of sprays is a conspicuous weakness.

The authors have forcefully and properly called attention (Chapter 26) to the contribution man is making toward the propagation of malaria through his ignorance and neglect. Community organization, economic, and social consideration in antimalaria work are well presented. In Chapter 28 we find a concise discussion of organization and procedures applicable to malaria control under military conditions. The authors conclude that: "Directives and organization, cooperation and integration, training and skill, supply and transport, have as much meaning in military malaria control as in any other phase of warfare. These basic factors, and above all, a

'malaria-conscious' high command are essential if malaria is to be controlled in highly endemic areas."

Section VI deals with therapeutic malaria. The techniques and safeguards in using malaria as a therapeutic agent are well presented.

Of special value to the field entomologist are the keys to the adult and fourth instar larvae of the *Anopheles* of the world by regions, as presented in the appendix. Each chapter is accompanied by a useful, though of course far from complete, list of bibliographical references.

F. C. BISHOPP

THE STORY OF THE MOSQUITO. Associated Executives of Mosquito Control of the State of New Jersey, N. J. Ag. Expt. Sta., Rutgers Univ. and County Mosq. Ext. Comm. Circular 502. Dec. 1946. 32 pp. Mosquito control in the State of New Jersey will be greatly facilitated by the recent publication of this booklet. For the compilation of this excellent pamphlet we are indebted to the Associated Executives of Mosquito Control of the State of New Jersey. It is designed particularly for use in the schools and by interested citizens of the State, and should be not only an effective force for Mosquito Control in New Jersey, but also an inspiration to all who desire to place educative materials in the hands of the present and uprising generations.

The front cover page of this well-prepared booklet (see inset) not only shows how the mosquito larvae develop and sustain life, but also depicts some of the chief operations in their control. The booklet tells how the control movement was started in New Jersey at Rutgers University in 1902 by Dr. John B. Smith, and how it has been spread by county commissions throughout the State.

The moving spirit and directing genius of the mosquito control movement in New Jersey, for 31 years after Woodrow Wilson signed the county commission bill into law, was the late Dr. Thomas J. Headlee. When Dr. Headlee came to New Jersey as State Entomologist in 1912, mosquitoes were a tremendous menace to the economic progress of the State. It was he who envisioned the vast improvement that would result from the elimination of the mosquito pest. Working through the county commissions, which are composed of six men appointed by the Supreme Court justices of the various counties, Dr. Headlee and his technical assistants, through careful planning and indefatigable efforts, brought the mosquito menace under control in New Jersey. They made it possible for that State to become one of the world's leading industrial centers. The inspiring leadership and vast accomplishments of Dr. Headlee brought him recognition and renown as one of the world's leading entomologists. The booklet indicates that his great work is now being carried on by capable hands.

In fascinating style and by well-drawn diagrams the booklet explains the life histories of the *Anopheles, Aedes,* and *Culex* mosquitoes, and how to identify them at any stage, particularly at the larval and pupal stages when their destruction is most desirable and readily effected. The relationship existing between mosquitoes and the incidence of malaria and other diseases is made quite clear.

A preliminary step in mosquito control, the pamphlet explains, is to determine both the density of the mosquito population and the kinds of mosquitoes prevalent. This is done by setting traps and studying the catch. Various methods of control are used for different kinds of mosquitoes which come from different breeding places.

Ditching is presented as the most feasible type of control for mosquitoes from salt water marshes. Ditches drain large areas, deter egg-laying by the tidal action of the water, and serve as highways for minnows which live on the larvae.

Fresh water, the booklet explains, presents a different problem. It must be drained off quickly after the rains, and oil applied where the drainage is incomplete. Toxic oils are more effective, because they both suffocate and poison the mosquito. Pyrethrum larvicide has all the values of oil, but is harmless to other aquatic life. Because of the dangers inherent in DDT its use is restricted, and it has not yet emerged from the experimental stage.

That the public should understand the principles and process of mosquito control is indicated throughout the pamphlet. How the public may participate is effectively presented in the explanation of what residents may do for the control of house mosquitoes. This section enumerates the ways of ridding the premises of all unnecessary mosquito breeding places, and advises the householder on everything from breeding fish in lily ponds to screening the house. "Ten commandments" of mosquito control climax the plea of the compilers for public cooperation.

The captivatingly conversational style and the wealth of well-selected illustrations will not only bring the lay reader a fascinating account of what is being done and what can be done for mosquito control, but will also develop the knowledge and inspire the desire to cooperate in the process.—Perry W. Ruth, Pres., Virginia Mosquito Control Assoc. and Past President, American Mosquito Control Association.

MOSQUITOES OF OKINAWA AND ISLANDS IN THE CENTRAL PACIFIC. By Richard M. Bohart and R. L. Ingram. NAVMED 1055. 110 pp., 16 plates and 2 maps. Bur. Med. and Surg., Navy Dept., Wash., D. C., 1946. This is another in the series of fine publications of the Navy Department on mosquitoes from relatively unsurveyed areas that became important during the war. The manual presents in readily usable form the available information on the taxonomy, distribution, and bionomics of the mosquitoes of Hawaii, Samoa, the Marshall Islands, the Caro-

New Jersey Agricultural Experiment Station, Rutgers University,
New Brunswick, New Jersey

lines, the Marianas, Okinawa, and Iwo. Much of the data is based upon personal collections but the extensive collections at the U. S. National Museum were also studied.

After a general introduction which points out the need for further study, especially of the medically important species, there is a brief account of the technique used in collecting, preparing, and preserving specimens. Sections on the mosquitoes of the various islands follow a description of the local characteristic terrain. Fifty-five species and subspecies are treated in detail, including the description of 3 new species and 1 new subspecies. Keys are given to the adults and larvae of Samoa, the Carolines, the Marianas, and Okinawa. Only 3 or 4 species are known from the other islands but these are well figured and hence keys are unnecessary. The keys are dichotomous, almost invariably contain 2 characters, and cite page references but usually not figure references. The keys employed are valid and are well illustrated and readily worked. In the text are descriptions of the male, female, larva, and egg (where possible). Notes on the biology, distribution, and relation to disease are included. Such description and discussion usually extends between one and two pages in length.

The plates are assembled at the end of the article. Morphological characters generally used in classification of adults and larvae are figured and labelled. These include side view of mosquito adult head, thorax and first abdominal segment, wings venation, *Aedes* and *Culex* male genitalia, head and abdominal segments eight and nine of larvae. A beginner can therefore easily learn the characters employed. The other 15 plates contain 64 sets of figures arranged according to species and illustrating important taxonomic features. Some sets actually include 7 figures under one number but all pertain to the one species. The figures are very good and clearly show the essential details, although the grade of paper employed by the printers does not do them justice. The plates are accompanied by an explanation and a list of sources of figures. The outline maps of Guam and Okinawa render distribution records meaningful.

The 3 pages of references cite Chinese, Japanese, and Russian publications, indicating that every effort was made to include all known records. The authors merit congratulations on their preparation of such a well illustrated and highly useful manual. Not only have they made determination of the known mosquito fauna of Okinawa and the Central Pacific Islands easy but they have stimulated further research.—Robert Traub, Dept. of Parasit., Army Medical Center, Wash., D. C.

LOS MOSQUITOS DE OKINAWA Y LAS ISLAS DEL PACIFICO CENTRAL. (Mosquitos of Okinawa and Island in the Central Pacific) por Richard M. Bohart y R. L. Ingram. NAVMED 1055. 110 páginas, 16 cuadros y 2 mapas. Bur. Med. and Surg., Navy Dept., Wash., D. C., 1946.

Es ésta una más en la serie de magníficas publicaciones del Departamento Naval sobre los mosquitos de zonas relativamento poco pesquisadas pero que recabaron importancia a causa de la guerra. El manual presenta en forma fácil de consultar los datos disponibles sobra la taxonomía, difusión y ecología de los mosquitos de Hawaii, Samoa, las Islas Marshall, las Carolinas, las Marianas, Okinawa y Iwo. Gran parte de los datos se basan en colecciones individuales pero también fueron estudiados las grandes colecciones en el Museo Nacional de los EE. UU.

A continuación de un prefacio general que pone de relieve la necesidad de estudios más amplios, especialmente de las especies de importancai médica, se presenta un breve relato de la técnica adoptada en recolectar, preparar y conservar los ejemplares. A seguir de descripciones de las características propias del terreno, hay secciones sobre los mosquitos de las varias islas. Se da un trato detallado a 45 especies y subespecies, incluso la descripción de 3 especies y 1 subespecie nuevas. Se presentan claves de adultos y larvas provinientes de Samoa, las Carolinas, las Marianas y Okinawa. Solamente se conocen 3 ó 4 especies de las otras islas pero éstas han sido bien dibujadas y por lo tanto no requieren claves. Las claves son dicótomas, casi siempre conteniendo 2 características y se citan las páginas a las cuales se refieren pero generalmente los dibujos no. Las claves empleadas son válidas, bien ilustrades y fáciles de aplicación. El texto contiene descripciones del macho, la hembra, la hembra, la larva y el huevo (de ser posible). Se incluyen notas sobre la biología, difusión y la relación con las enfermedades. Dichas descripciones y discusiones por lo general ocupan una ó dos páginas.

Los cuadros se presentan juntos al fin del artículo. Las características morfológicas generalmente empleadas en la clasificación de los adultos y las larvas están númeradas y rotuladas. Estos incluyen una vista lateral de la cabeza del mosquito adulto, del tórax y del primer segmento abdominal, nervadura de las alas, genitales masculinos de *Aedes* y *Culex*, cabeza y segmentos abdominales octavo ye noveno de la larva. Por lo tanto es fácil para los aprendices llegar a conocer las características empleadas. Los otros 15 cuadros contienen 64 juegos de dibujos arreglados según la especie e ilustrando importantes aspectos taxonómicos. De hecho algunos de los juegos incluyen 7 dibujos bajo un solo número pero todos pertenecientes a una sola especie. Los dibujos están muy bien hechos e indican claramente los detalles esenciales, no obstante que la clase de papel usado por los impresores no les hace justicia. Accompañan los cuadros una explicación y una lista de fuentes de los dibujos. Los mapas de contorno de Guam y Okinawa facilitan la comprención de los datos sobre la difusión.

Las 3 páginas de la bibliografía consultada incluyen publicaciones chinas, japonesas y rusas, lo cual implica que se han agotado esfuerzos para incluir todos los datos hoy conocidos. Los autores merecen un aplauso por haber preparado un manual tan bien ilustrado y de tanta utilidad. No solamente han hecho fácil la determinación de la fauna hoy conocida en cuanto se refiere a los mosquitos de Okinawa y las islas del Pacífico Central, sino que también han dado un estímulo para pesquisas en el futuro.—(Translation of a review by Robert Traub.)

TIRES AS A FACTOR IN THE TRANSPORTATION OF MOSQUITOES BY SHIPS. By J. J. Pratt, Jr., R. H. Heterick, J. B. Harrison, and L. Haber. Military Surgeon 99(6):785–8. 1946. Several living adult mosquitoes were observed in the hold of a ship during a routine Public Health Service quarantine inspection at the Port of Los Angeles. Investigation revealed that mosquitoes were breeding in fresh water standing in tires which had been salvaged from Biak, Netherlands East Indies. This discovery led to the adoption of control measures for subsequent shipments unloaded at the Port. As the equipment was loaded into freight cars, tires, and any other material containing water were sprayed with 5% DDT in kerosene. Ceilings, floors, and walls of the cars were sprayed with the DDT mixture as a precaution against any adults which might emerge.

A detailed table of inspections and shipments covers the period from July 6, 1945 to February 4, 1946. Eleven shipments, each containing tires, are recorded: water was found in 9 shipments. There were immature mosquitoes in the water in 4; 3 of these 4 included living larvae and adults, the other one, dead pupae. In one shipment, 12 amphibious vehicles contained water, but no mosquitoes.

The species found were *Aëdes scutellaris hebredius* Edwards, *Armigeres obturbans milnensis* Lee, *Culex papuensis* Taylor, *Tripteroides* (near) *quasiornata* Taylor, *Megarhinus* sp., and *Aedes albopictus* Skuse. One dead adult of *Culex annulirostris* Skuse was found. The geographical distribution and disease relationships of these mosquitoes are summarized. H. L. Trembley, National Inst. Health, Bethesda, Md.

LAS LLANTAS DE AUTOMOTOR COMO FACTORES EN EL TRANSPORTE DE MOSQUITOS EN BUQUES. Por J. J. Pratt, Jr., R. H. Heterick, J B. Harrison, y L. Haber. Military Surgeon 99(6):785–8. 1946. Varios mosquitos adultos vivos fueron observados en la bodega de un buque en el curso de una inspección rutinaria de cuarentena efectuada por el Servicio de Salud Pública en el puerto de Los Angeles. Una investigación reveló que mosquitos estaban reproduciéndose en agua dulce contenida en llantas que se habían recobrado en Biak, Indias Orientales Holandesas. Este descubrimiento dió como resultado la adopción de medidas de control sobre los cargamentos recibidos subsecuentemente en ese puerto. Visto que el material fué luego cargado en vagones de ferrocarril, las llantas y todo otro objeto que contenía agua fueron pulverizados con una solución de DDT al 5% en kerosene. Los techos interiores, pisos, y paredes de los vagones fueron pulverizados con la mixtura de DDT como una precaución contra los adultos ques pudieran aparecer.

Un cuardo detallado de inspecciones y cargamentos abarca el período desde el 6 de julio de 1945 hasta el 4 de febrero de 1946. Fueron registrados once cargamentos que incluían llantas, y se encontró agua en nueve de ellos. Había mosquitos inmaturos en el agua de 4; 3 de estos cuatro contenían larvas vivientes y adultos, y el otro contenía ninfas muertas. En uno de los cargamentos, 12 vehículos anfibios contenían agua pero no había mosquitos.

Las especies que se hallaron eran *Aëdes scutellaris hebredius* Edwards, *Armigeres obturbans milnensis* Lee, *Culex papuensis* Taylor, *Tripteroides* (near) *quasiornata* Taylor, *Megarhinus* sp., y *Aëdes albopictus* Skuse. Hallóse un adulto muerto de *Culex annulirostris* Skuse. Se presenta un resumen de la distribución geográfica y la relación entre estos mosquitos y las enfermedades. (Trans. of a review by H. L. Trembley.)

THE POSSIBLE USE OF BATRACHIAN *XENOPUS laevis* IN THE FIGHT AGAINST THE LARVAE OF MOSQUITOES; DIVERSE INTERACTIONS FORESEEN. (UTILISATION EVENTUELLE DU BATRACIEN *XENOPUS laevis* DANS LA LUTTE CONTRE LES LARVES DE MOUSTIQUES; INTERACIONS DIVERSES A PREVOIR.) By E. Brumpt. C. R. Acad. Sci. 220: 923–5, 1945. In Crau and Camargue, Corsica, *Gambusia* has aided greatly in diminishing the mosquito population, although the fish has numerous enemies such as the voracious catfish (*Amiurus nebulosus*), sun perch, toxic plants and man. The author's laboratory study of *Xenopus laevis* as a mosquito control agent was prompted by the success of R. Martin's work at Addis-Ababa where it was found that *X. clivii* are capable of devouring larvae and pupae at the rate of 100 to 115 per 24 hour period. One *X. laevis* weighing 5g. was placed in an aquarium with 10 larvae and 10 pupae of *Stegomyia* and 15 larvae and 10 pupae of *Anopheles maculipennis*. All of the insects were consumed in less than one hour.

It was found that *X. laevis* is very carnivorous and can be reared in the laboratory with pieces of meat or with various living prey which are eaten under water. This behavior may influence the effectiveness of *laevis* as a larvivorous agent because of the possibility of introducing problems of ecological balance should they be used for the control of mosquitoes. The author, however, recommends the use of *X. laevis* in Corsica and Algeria despite these limitations.—J. B. Gerberich, Michigan State College, East Lansing, Michigan.

LA POSIBILIDAD DE EMPLEAR EL BATRACIO *XENOPUS laevis* EN LA LUCHA CONTRA LAS LARVAS DE MOSQUITOS; DIVERSAS ACCIONES RECIPROCAS QUE SE PREVENN. Por E. Brumpt. C. R. Acad. Sci. 220:923–5. 1945. En Crau y Camargue, Córcega, la *Gambusia* ha ayudado mucho para reducir el número de los mosquitos, aunque este pez tiene muchos enemigos, tales como el voraz siluro (*Amiurus nebulosus*), la percha de sol, plantas tóxicas y el hombre. El estudio que hizo el autor en el laboratorio sobre el *Xenopus laevis* como agente en el control de mosquitos fué motivado por el éxito que tuvo el trabajo de R. Martin en Addis-Ababa, donde se verificó que los *X. clivii* son capaces de devorar larvas y ninfas a razón de 100 á 115 en un período de 24 horas. Un *X. laevis* que pesaba 5g. fué colocado en un acuario junto con 10 larvas y 10 ninfas de *Stegomyia* y 15 larvas y 10 ninfas de *Anopheles maculipennis*. Todos los insectos fueron consumidos en menos de una hora.

Se verificó que el *X. laevis* es muy carnívoro, y que se puede criar en el laboratorio, alimentándolo con carne desmenuzada y con presa viva de varias clases que el batracio come debajo de la superficie del agua. Puede ser que esta manera de comer afecte la eficacia del *laevis* come agente larvívoro a causa de la posibilidad de que se introduzcan problemas de equilibrio ecológico, caso que fuera empleado para el control de mosquitos. No obstante, el autor recomienda el empleo de *X. laevis* en Córcega y Argelia a pesar de estas limitaciones.—(Translation of a review by J. B. Gerberich, Michigan State College, East Lansing, Michigan.)

THE MALARIA OF THE ANDEAN REGION OF SOUTH AMERICA. By L. W. Hackett. Rev. Inst. Salub. y Enferm. Trop. 6(4):239–252. 1945. *A. pseudopunctipennis* is the principal and usually the only cause of malaria in the Andean valleys of South America between 250 meters and 2,500 meters above sea level. In latitude it maintains endemic malaria as far south as 31° in Argentina (Córdoba), and in favorable years may produce small epidemic outbreaks one or two degrees further south (to Mendoza); in Chile however its southern limit and that of malaria is the valley of Pica (inland from Iquique), at 20° 30′ south latitude. It appears to reach its maximum altitude in the Cinti valley of Bolivia at 2600 meters and there it causes what is probably the highest malaria in the world. The upper limit of its range is so variable not only in different valleys, but also in the same valley in different years that water temperature is probably of more importance than barometric pressure as the limiting factor. To the north, it is the commonest anopheline in upland valleys of Colombia and Central America, but does not appear to be an effective vector of malaria between Ecuador and Guatemala; perhaps we are dealing with more than one species under the name of *A. pseudopunctipennis*. — Author's summary.

THE MALARIA OF THE ANDEAN REGION OF SOUTH AMERICA. By L. W. Hackett. Rev. Inst. Salub. y Enferm. Trop. 6(4):239–252. 1945. *A. pseudopunctipennis* es la principal y generalmente la única causa del paludismo endémico en los valles endinos de América del Sur, entre 250 y 2,500 metros sobre el nivel del mar. En latitud, mantiene paludismo endémico haste 31° en Argentina (Córdoba), y en años favorables puede producir ligeros brotes epidémicos uno o dos grados más al sur (hasta Mendoza); en Chile, sin embargo, su limite meriodional, asi como el del paludismo, es el valle de Pica (al interior de Iquique), a 20° 30′ latitud sur. Alcanza su mayor altitud en el valle de Cinti en Bolivia, a 2,600 metros, donde produce el paludismo más alto del mundo. El limite superior de su alcance es muy variable, no sólo de un valle a otro sino aún en el mismo valle, en años diferentes, lo que hace pensar que la temperatura del agua es probablemente más importante que la presión barométrica como factor limitante. Hacia el norte, es el anofeles más comun el las altiplanicies de Colombia ye de Centro América, pero no parece ser un vector efectivo de paludismo entre Ecuador y Guatemala; quizá, bajo el nombre de. *A. pseudopunctipennis* se estén agrupando más de una especie.(—Author's translation of summary.)

THE DISTRIBUTION OF MOSQUITOES OF MEDICAL IMPORTANCE IN THE PACIFIC AREA. Bureau of Medicine and Surgery, Navy Department, Washington, D. C. 1946. NAVMED 983, pp. 1–64, illus. This atlas includes 18 species and subspecies of genus *Anopheles*, 6 species of *Aedes* (5 in subgenus *Stegomyia*), 2 *Culex*, and 4 *Mansonia*. Full-page maps, about 13 by 16 inches, show the distribution of each species, and opposite each map is a page of text giving systematic notes on the species and a brief review of bionomics, relation to disease, distribution, and the sources of distribution records. An extensive bibliography is appended. In addition to the Pacific islands, the area covered includes the Asian mainland as far as eastern India.

The list of *Anopheles* as selected includes species that vary greatly in their importance as vectors of malaria, particularly in different parts of their range. For example, at least 9 of the 18 species are shown as occurring in the Philippines, whereas only a single one of these, *A. minimus flavirostris* (shown on the map merely as *minimus*) is considered by workers there to be of real importance. A number of widely distributed species are included on the basis of reports from a single locality or a restricted area. Since no distinctions of this nature are indicated on the maps, the latter are misleading in this respect. The records, however, are provided in the text, and the paper as a whole is a useful one. The large size of the publication makes it

a difficult one to file.—W. V. King, Bureau of Entomology and Plant Quarantine, Orlando, Fla.

Distribución de los Mosquitos de Importancia Médica en la Zona del Pacifico (The Distribution of Mosquitoes of Medical Importance in the Pacific Area). NAVMED 983, páginas 1–64, illus. Bur. Med. Surg. Navy Dept., Wash., D. C., 1946. Este atlas abarca 18 especies y subespecies del género *Anopheles,* 6 especies del *Aedes* (5 en la subgénero *Stegomyia*), 2 *Culex* y 4 *Mansonia.* Mapas de plana antera, 13 por 16 pulgadas más o menos, indican la distribución de cada especie, confrontadas por sendas páginas de texto con notas sistemáticas sobre la especie y una breve revista de su ecología, relación con las enfermedades, distribución y fuentes de los datos sobre las cuales se basa. Se agrega una bibliografía amplia. Además de las islas del Pacífico, la zona abarcada incluye la tierra firme asiática hasta la región oriental de la India.

La lista de *Anopheles,* como ha sido escogida, incluye especies que varían mucho en cuanto a su importancia como vectores de malaria, especialmente en distintas partes de su esfera de actividad. Por ejemplo, no menos de 9 de las 18 especies se representan como ocurriendo en las Filipinas, cuando de hecho solamante una el ellas, *A. minimus flavirostris* (indicado en el mapa como *minimus*), es considerada por investigadores de la región como de verdadera importancia. Se ha incluido un número considerable de especies con una distribución muy extensa solamente a base de informes sobre una sola localidad o una zona muy limitada. En vista de que las indicaciones en los mapas no hacen distinciones a este respecto, bien pueden conducir a interpretaciones erróneas sobre este particular. Los datos, sin embargo, están incluidos en el texto, y la obra en lo general puede ser útil. El tamaño exagerado del tomo lo hace difícil de archivar.—Translation of a review by W. V. King.

Microbiología Insectologíca (Insect Microbiology), por E. A. Steinhaus. Comstock Publishing Co., Inc. 763 y X páginas, 1946. Esta obra única de su genero, aunque sus implicaciones son muy amplias, entraña gran interes para todo investigador en el campo de la biología y el control de los insectos. Es un relato extenso de los microbios asociados con insectos y ácaros (garrapatas y otros arácnidos) con atensión especial a las relaciones biológicas a esperarse. El autor pone de relieve que no obstante no ser una obra sobre la patología insectológica, ni tampoco sobre la entomología médica, se ha hecho una tentativa de incluir las relaciones biológicas que existen entre los agentes patogénicos y sus huéspedes artrópodos y sus vectores, así como todos los que existen entre agentes no patogénicos y los insectos, las garrapatas y los arácnidos en general.

Contiene 13 capítulos, cada uno dedicado al trato por separado de los siguientes temas: bacteria extracelular y los insectos, bacteria específica asociada con insectos, simbiotes intracelulares que se asemejan a las bacterias o las rickettsias, las rickettsias, levaduras y los insectos, virus y los insectos, mohos y los insectos, espiroquetas en asociación con insectos y ácaros, protozoos e insectos, protozoos y comegénes, inmunidad en los insectos, métodes y procedimeintos. Hay 88 páginas de referencias y un índice de autores que comprende 12 páginas. El índice de materias merece caluroso elogio; consiste de más de 57 páginas. Hay alrededor de 270 referencias individuales en el índice con respecto a los mosquitos, v.g. *Culex tarsalis* Coq., asociado con la bacteria, *Pasteurella tularensis,* págs. 166 y 168; asociado con virus, encefalitis pág. 438, encefalitis St. Louis págs. 438 y 439; encefalitis equino occidental págs. 438 y 439.

El Dr. Steinhaus, autor de la obra, es de sobra conocido por sus excelentes contribuciones en el campo de las relaciones biológicas que existen entre los agentes patogénicos para con el hombre, los animales y las plantas, así como los que existen entre los microbios no patogénicos y sus huéspedes. El autor se ha merecido un alto encomio por haber reunido en forma sistemática esta voluminosa información que con anterioridad estaba práticamente fuera del alcance general. El Dr. Steinhaus figuró antiguamente entre la oficialía del Servicio de Salud Pública de los Estados Unidos y actualmente forma parte del Departamento de Agricultura de la Universidad de California en la División de Control Biológico. (Translation of a review by W. B. Herms, Berkeley, California, which appeared in the March [1947] number of Mosquito News.)

La Situación Con Respecto a Los Insecticidas. (The Insecticide Situation.) Por F. C. Bishopp. J. Ec. Ent. 30(4):449–59, 28 referencias. 1946. Debido a las condiciones que tuvieron su origen en la guerra, se hizo imposible obtener abastos adecuados de cobre, piretro y rotenona para la manufactura de los indispensables insecticidas. Esto dío como resultado una distribución rígidamente controlada para atender a las necesidades más apremiantes, y a una búsqueda intensiva descubrir nuevos insceticidas. En este artículo el autor puncualiza el paso sin precedente con el cual se va adelantando la investigación en el ramo de los insecticidas y pasa brevemente en revista los siguientes temas: tratamiento de las semillas, fumigantes, materia de origen vegetal para insecticidas y los compuestos orgánicos sintéticos. Varios insecticidas, inclusos *sabadilla, Ryania, hidroxipentametilflavina, hexacloruro de benceno, DDT, TDE, metóxido análogo al DDT, bromuros y fluoruros análogos al DDT, benzoato de bencilo, sulfones y sustancias sinérgicas,* son comentados algún detalle.

Los efectos que el hexacloruro de benceno (1,2,3,4,5,6 hexaclorociclohexanona) ejerce sobre los diferentes insectos según los datos recabados por varios investigadores, han sido pasados en revista. Se subraya la urgencia de amplios

trabajos químicos, biológicos y toxicológicos respecto a este insecticida de tanta promesa hasta lograr conocimientos cabales de sus potencialidades y de sus limitaciones. Como era de esperarse, el DDT aun conserva su lugar predilecto en el campo de los insecticidas. Debido a que por lo general está al alcance de todos, el público ha tenido la oportunidad de evaluar el DDT. No obstante todas las investigaciones llevadas a cabo con el DDT y la popularidad universal de que goza, aun quedan muchas cosas por averiguar, particularmente las posibilidades de numerosos efectos secundarios producidos por la aplicación del DDT.

Se presume que debido al interes despertado por la propaganda a favor del control de los insectos durante la guerra, como también la multiplicación de los problemas que a ella se debieron, el uso de los insecticidas en los Estados Unidos y en otras partes del mundo aumentará considerablemente. Se cree que los Estados Unidos jugarán un rol sobresaliente en la producción de insecticidas para otros países. El descubrimiento de las posibilidades del DDT ha revivificado y ha inspirado neuvas esperanzas a nuestros esfuerzos para hallar un mortífero y potente destructor de insectos mediante la investigación de grupos químicos que con anterioridad se creía eran de poca promesa como insecticidas. Se pueden anticipar nuevos desarrollos en el campo insecticida dentro de pocos años. El autor pone énfasis en el hecho que los insecticidas orgánico sintéticos son más o menos específicos y que no hay que anticipar que cualquiera de ellos sea una panacea. Por lo tanto se debe seguir adelante con la búsqueda de otros insecticidas para llenar las lagunas en el control de los insectos.—(Translation of a review by S. J. Carpenter, National Biscuit Company, New York, N. Y., which appeared in the March [1947] number of MOSQUITO NEWS.)

ECOLOGICAL PICTURE OF *A. (N.) tarsimaculatus* Goeldi, 1905, IN NORTHEAST BRAZIL. Durval T. Lucena. A Folha Medica 27(15):1–46. Serviço Nacional de Malaria, Rio de Janeiro, 1946.

1. *Anopheles tarsimaculatus* Goeldi, 1905, has been referred to as an anopheline mosquito breeding along the coastal plains, certain authors reporting it living some few miles inland, in this case breeding in fresh water.

2. This paper is an attempt to clarify some of its ecological habits. Geographical distribution is successively studied (a) in Neotropical Region; (b) in Brazil and (c) particularly in Northeast of this country. Here the species was found in the Interior of the States of Pernambuco and Parahyba, respectively, at distances of 252 kilometers at Olho d'Agua dos Pombos, and 115 kilometers at Queimadas, far from the coast.

3. Physiography and preference to certain areas in the referred States are emphasized. The species is in so close dependence to salt diluted in water of breeding places from Zones of "Littoral," "Matta" and "Agreste," that eggs oviposited by females captured in localities of high salinity rupture when laid in tap water. Besides sea water in coastal plains, rocks and soil provide salt for places where the mosquito breeds in the Interior. In João Pessôa, State of Parahyba, larvae of *Anopheles tarsimaculatus* were found in breeding places for fishes which water contained 33.345 grs. of salt per liter, while in Pernambuco, in the locality Russinha ("Agreste"), larvae breed in water until with 29.835 grs. of salt per liter.

4. Seventy-six samples of water of breeding places were tested for chlorides obtained from the Zones "Littoral," "Matta" and "Agreste." Results are shown in Table II. According to these data and a bibliographical revision it was possible to determine the zone of high salinity of Northeast that probably corresponds to the zone of *tarsimaculatus* incidence in the interior.

5. The following adults' habits were studied: (a) domesticity, (b) seasonal prevalence, (c) hour of penetration into houses. Zoophilic and anthropophilic habits were referred to as well.

6. *A. tarsimaculatus* was believed to be autochthonous in the Interior of Northeast States of Brazil: (a) because it breeds in salt water; (b) it was found inland 252 kilometers distant from the sea; (c) the water of streams, rivers, lakes, etc., in this region always contains salt; (d) geologically this is the most ancient region in South America.—Author's summary.

BOSQUEJO ECOLOGICO DEL *A. (N.) tarsimaculatus* Goeldi, 1905, EN LA REGÍON NORESTE DEL BRASIL (Esboço ecológico do *A. (N.) tarsimaculatus* Goeldi, 1905, no Nordeste Brasileiro). Durval T. Lucena, Excerpta de *A Folha Medica*, No. 15, 1946. Páginas 44 y 45.

RESUMEN

1. Se han hecho referencias al *Anopheles tarsimaculatus* Goeldi, 1905, como un mosquito anofelino que se cría en las planicies del litoral, y ciertos autores relatan haberlo encontrado viviendo unas cuantas millas tierra adentro, en estos casos criándose en agua dulce.

2. Esta obra es un intento de esclarecer algunos de sus hábitos ecológicos. Sucesivamente se ha estudiado la distribución geográfica en: (a) Región Neotropical; (b) el Brasil; y (c) espeçialmente la región noreste de aquel país. Allí se ha encontrado la especie en el interior de los estados de Pernambuco y Paraíba, repectivamente distantes de la costa, 252 kilómetros en Olho d'Agua dos Pombos, y 115 kilómetros en Queimadas.

3. Se pone de relieve la fisiografía y la preferencia para ciertas zonas en dichos estados. Tan estrechamente está ligada esta especie con la sal diluida en el agua de los criaderos de las zonas del Litoral, el bosque y el Agreste, que los huevos ovipuestos en agua de grifo por hembras capturadas en localidades de alta salinidid, revientan al ponerse. Además del agua salina en las

planicies costeñas, las rocas y el suelo proporcionan sal en las localidades en las cuales se cría el mosquito en el interior. En João Pessôa, estado de Paraíba, se encontraron larvas del *Anopheles tarsimaculatus* en criaderos para pescados, cuya agua contenía 33.345 gr. de sal al litro, mientras que en Pernambuco, en la localidad de Russinha (Agreste), se crían las larvas en agua hasta con 29.835 gr. de sal al litro.

4. Se hizo un analisis de los cloratos en setenta y seis muestras de agua tomada de criaderos en las zonas del Litoral, el Bosque y el Agreste. Se dan los resultados en el cuadro II. A base de estos datos y una revisión bibliográfica fué posible determinar la zona de alta salinidad en la region noreste, la cual en toda probabilidad corresponde a la zona de incidencia del *tarsimaculatus* en el interior.

5. Se hizo el estudio de los hábitos siguientes en los adultos: (a) domesticidad, (b) prevalencia estacional, (c) hora de penetración en las habitaciones. También se hace referencia a los hábitos zoofílicos y antropofílicos.

6. El *A. tarsimaculatus* se consideró autóctono en el interior de los estados en el noreste del Brasil porque: (a) se cría en agua salina; (b) fué encontrado a distancias de 252 kilómetros tierra adentro del mar; (c) las aguas de las corrientes, los ríos, los lagos, etc., de esta región siempre contiene sal; (d) del punto de vista geológico, ésta es la región más antigua de Sur América. (Translation of author's summary.)

Bibliography of Aviation in Economic Entomology compiled by Ina L. Hawes and Rose Eisenberg. Bibliographical Bul. 8, U. S. Dept. of Agric. 186 pp., April, 1947. This annotated bibliography presents a good coverage of the literature relating to the use of aircraft in entomological work. The bulletin lists and abstracts 1,084 publications. These are listed chronologically and alphabetically. The first publications in this field appeared in 1919 and the literature is covered through 1944. A good many (55) references for 1945 are included but no effort was made to cover fully the publications of that year. The references include those relating to control of mosquitoes, crop pests, forest insects, and to the transportation of disease vectors and means of preventing their movement. The insects involved, materials, equipment, and techniques are indicated in the abstracts. Included also are references to publications relating to aerial surveys, mapping, aerial fauna and the relation of aircraft distribution of insecticides to bee and livestock poisoning.

One of the first reported uses of airplanes in the entomological field was by C. Gordon Hewitt in 1919 for surveying mosquito breeding areas in Canada. The number of references relating to mosquito control has increased rapidly since 1930.

A comprehensive author and subject index is included. F. C. B.

Bibliography on Aviation and Economic Entomology (Bibliografía de la Entomología por Avión y su Aspecto Económico) recopilado por Ina L. Hawes y Rose Eisenberg. Bibliographical Bul. 8, U. S. Dept. of Agric. 186 pp, April, 1947. Esta bibliografía anotada presenta una revista concienzuda de la literatura sobre el uso de aeroplanos en trabajos entomológicos. El boletín contiene una lista de 1,084 publicaciones y extractos de ellas. La lista está recopilada cronológica y alfabéticamente. Las primeras publicaciones en este campo aparecieron en 1919 y las incluidas abarcan el periodo hasta fines de 1944. También se ha incluido regular número (55) de datos correspondientes al año 1945, pero no se has propuesto abarcar todas las publicaciones de este año. Los extractos inculidos son los referentes al control de los mosquitos, de las plagas dañinas a las mieses, insectos forestales, y al transporte de vectores de las enformedades y los medios de evitar dicho movimiento. Los extractos indican los insectos de que se trata, los materiales, el equipo y la técnica. Igualmente se han incluido datos referentes a publicaciones sobre enquestas aéreas, topografía, fauna aérea y la relación entre la distribución de insecticidas por aeroplano y el envenenamiento de las abejas y el ganado.

Uno de los primeros en usar aeroplanos en el campo entomológico y de quien se tienen informes fué C. Gordon Hewitt en 1919, quien les empleó para levantar planos de las regiones en el Canadá que contienen criaderos de mosquitos. El número de datos referentes al control de mosquitos ha aumentado rápidamente desde 1930.

También se incluye un índice extenso de autores y temas.—Translation from a review in English by F. C. Bishopp.

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